

PROCEEDINGS
AND
ANNUAL REPORT

OF THE

Holmesdale Natural History Club,

REIGATE,

FOR THE YEAR 1865-66;

ALSO,

RULES OF THE CLUB,

AND

LIST OF MEMBERS.

LONDON:

PUBLISHED FOR THE HOLMESDALE NATURAL HISTORY CLUB, REIGATE,
BY JOHN VAN VOORST, 1, PATERNOSTER ROW.

Price One Shilling.

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E. NEWMAN, PRINTER, DEVONSHIRE STREET, BISHOPSGATE.

PROCEEDINGS
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HOLMESDALE NATURAL HISTORY CLUB.

EVENING MEETINGS.

October 13th, 1865.—Mr. Lees brought for exhibition a considerable length of fibrous matter which had been taken out of some drain-pipes only laid down in the month of September, 1864, and which had completely filled up the pipes. The fibrous matter was the roots of the Alder (*Alnus glutinosa*), and reached the great length of 14 feet in the space of nine months, to June last, when the pipes were taken up.

Mr. Sydney Webb brought for exhibition the eggs of two species of insects. One of these, the Lacewinged Fly, is a frequenter of gardens, hedge-rows and coppices, and may be met with from the beginning of May to the end of October. The larva is carnivorous, feeding on the Aphis, of which it devours immense quantities. The eggs, some eight or ten in number, are deposited at the extreme end of a silken thread of about five lines in length, which is first spun and securely attached to a leaf by the insect. The other specimen consisted of the shell-cases of the egg of some small moth, from which the caterpillar had already been hatched, and showed most distinctly the different cells and natural doors for closing the openings to them.

The President brought for exhibition a very fine specimen of the large spreading Fungus, *Polyporus squamosus*, obtained from

Greening's Farm, Charlwood, and remarkable from the size it had attained during an unusually long and dry season.

He also exhibited several very large Barnacles which had recently been taken off the bottom of an iron ship, which, since she was last in dock, had only made two voyages to the Pacific and back, occupying a period of less than two years. The ship's bottom appears to have been covered with these multivalve shells, much impeding her passing through the water, whilst the rapidity of the growth of these shells and their rapid multiplication are well worthy of note.

He also exhibited and drew the attention of the Meeting to three fine specimens of the Death's Head Moth, which had been taken in this neighbourhood quite recently. He stated that the fine hot summer had caused a considerable number of these moths to arrive at the winged state, and that they had appeared in many parts of the country.

The President mentioned that recently there had been some very fine effects of diverging rays in the west, about the time of sunset. One evening, about ten minutes after the sun had set, and the sky was free from clouds, these rays were very strong and remarkable, radiating from about where the sun would be beneath the horizon, and spreading to nearly over the head of the spectator: he attributes these rays to the shadows of distant hills on a sky full of humidity.

The President then called the attention of the Meeting to the fact that roots of trees often anastomise in a very remarkable and complicated way, while the branches very seldom are known to do so. Some excellent examples of these roots anastomising had been noticed in the sandy lanes near Leith Hill, during a recent excursion of the Club to that interesting locality. Further information on this subject would be very desirable, particularly as to the cause of this inarching of the roots one on another, and the trees which most frequently have the process carried out among their roots.

The Secretary exhibited specimens of *Choanites Konigii* from the chalk flints of the Isle of Wight. The Choanite is an extinct form of animal life, and in the scale of creation occupied a position between Bryozoa and Echinodermata. Its outer form was not unlike that of a Sea Anemone, but it possessed organs of a higher order.

November 10th, 1865.—Dr. Iliff, of Epsom, forwarded for exhibition a small cubical hard and stone-like substance, which, with ten others precisely similar in character, had been taken from the stomach of a sole. The object exhibited was nearly cubical, sides quite flat, and exterior angles slightly rounded, and was exhibited with the hope of gaining some information as to the nature of this substance.

The President exhibited a series of Gourds grown at Reigate during the present year. They were almost all varieties of the *Melo pepo*, which are good for food, and known by their yellow flowers and furrowed fruit-stalks. Two or three varieties of other gourds were shown, possessing qualities which render them unfit for human food. The fruit-stalks of these were smooth, and their flowers white, characters which readily distinguish them from the edible species. Among the edible varieties exhibited, some had the shape and size of pears and oranges, while others were much elongated and weighed many pounds each. Upwards of twenty well-marked varieties were placed upon the table. The President stated that the past summer had offered conditions for the growth of the gourd tribe not often found in this country—viz. heat, with bright sunshine and a moist atmosphere. Besides gourds, many other fruits had come to unusual perfection this season, several of which ripened but very rarely in the open air.

The President also brought for exhibition a number of skulls, by which he proved that the skull found on Reigate Hill, and was previously before the Club, was that of a Badger, and that the skull from Buckland, exhibited at a recent meeting of the Club, was that of the common Dog: both had been long in the ground.

He also exhibited a curious fungus of a reddish mahogany colour, *Polyporus lucidus*, which had been found in this country. The fungus is a tropical species, and seldom found so far north as this latitude. He also exhibited some fruits of the Edible Myrtle (*Eugenia ugni*) from Chili, which were handed round among the members.

The President drew the attention of the Meeting to the rainfall in the South of England during the past month, which he believed to have been greater than ever before recorded. It varied in different localities from 7 to 11 inches. At Reigate the amount collected in the guage was a little more than 7 inches.

December 8th, 1865.—The Secretary exhibited, on behalf of Dr. J. A. Power, of 52, Burton-crescent, London, the following 15 species of Coleoptera, all taken by himself, and not previously recorded as occurring in the Reigate district:—

- Borboropora Kraatzii*, Fuss. One specimen, which is unique in England, taken by sweeping in the "Hilly Field," Mickleham, July, 1862. The only other specimens known are one taken by Dr. Aubé, near Paris, and six specimens taken by Herr Fuss, in Germany, under the carcase of a toad.
- Oxyopoda glabriventris*, Rye. From a nest of *Formica fuliginosa*, near Mickleham. This species, which is new to Science, has been captured in no other locality.
- Oxytelus speculifrons*, Kraatz. From Mickleham.
- Oxylamus variolus*, Dufour. Two specimens, under bark of a dead tree, Mickleham.
- Atomaria ferruginea*, Sahlb. Nest of *Formica fuliginosa*, Mickleham.
- Euplectus Kunzei*, Aubé. Under bark of dead tree, Mickleham.
- Cicones variegatus*, Hellw. Under bark of dead tree, Mickleham.
- Quedius truncicola*, Fairm. Mickleham.
- Ptinella aptera*, Guer. }
 „ *limbata*, Heer. } Under bark of dead trees, Mickleham.
 „ *denticollis*, Fairm. }
- Stenus longitarsis*, Th. Banks of the Mole, near Burford Bridge.
- Oxyopoda nigrofusca*, Waterh. Mickleham.
- Scymnus Mulsanti*, Waterh. Roots of grass, Buckland Hill.
- Epurea oblonga*, Herbst. Under bark of pine, Shirley.

Mr. Thomas Cooper brought for exhibition specimens of the fruit of *Cucumis myriocarpus*, a most beautiful little gourd, about the size of a gooseberry, which had been grown in his garden. He also exhibited a very small and interesting species of Cactus, very curiously variegated.

The President drew the attention of the Meeting to the Meteorology of the past month at Reigate, particularly alluding to the quantity of rain which had fallen, amounting to $3\frac{3}{4}$ inches, making a total for the current year of $32\frac{1}{4}$ inches, very much exceeding the average.

The President brought for exhibition a collection of variegated plants of different kinds, showing the various ways in which the leaves of plants were variegated, some naturally so, and some the result of sport improved upon by cultivators, and then made almost permanent under certain conditions of growth. He explained the various kinds of variegations usually met with on the leaves of plants, and how many of them had originated, drawing attention to the fact that most of the white variegations commenced in an unhealthy state of the plant. He then brought before the Meeting some extraordinary facts connected with the larva of two-winged or dipterous insects. He stated that it had been proved by naturalists in Prussia and Germany that some Diptera had viviparous larva; that is, that the larva had the power of producing other larva like themselves through several stages, and that the last-formed larva went into the state of chrysalis and then produced the perfect insect. This viviparous nature of dipterous larvæ is quite a new fact in Entomology. The insect in question producing these remarkable larvæ is new to Science, and has been called *Miaster metreleus*.

The President alluded to a large specimen of the Finner Whale (*Physeter Tursio*) which had recently been cast on shore near Pevensy: it measured 70 feet in length, with the jaws about 16 or 18 feet long.

He also called the attention of the Meeting to a very remarkable new sea animal, one of the Ascidian group, having a fleshy valve covering the parts of the mouth and other orifices of the body, something similar to the lid of a tankard, which lid or valve opened and shut at the pleasure of the animal. This new form has been called *Cheoreuleus callensis*. He also pointed out some peculiarities in a small shell called *Plectostoma*, which he exhibited, and which had a long projecting mouth shaped like a trumpet.

January 12th, 1866. The Secretary exhibited the following three species of Coleoptera, taken by himself, and not previously recorded as occurring in the Reigate district:—

Prognatha quadricornis, Kirby. Under bark of dead tree, Mickleham.

Mycetoporus lucidus, Er. }
Canopsis Waltoni, Schon. } From moss, Shirley Common.

He also exhibited the following seven species of Coleoptera on behalf of Dr. Power, all new to the Reigate district:—

Agaricophagus conformis, }
Oligota apicata, Er. } From Mickleham.

Phyllotreta sinuata, Steph. Hills east of Merstham.

Hydrobius punctatus. Purley Oaks.

Epurea diffusa, }
Apion Hookeri, Kirby } From Shirley.
Sibynes primitus, Herbst.

Mr. John Linnell, junior, exhibited the following three species of *Homalota*, taken by himself, and new to the Reigate district:—

Homalota intermedia. From a dead hedgehog, in Redstone Wood.

„ *autumnalis*. In rotten wood, Gatton Park.

„ *nigritula*, Gr. In Fungi, Redstone Wood.

Mr. Sydney Webb sent for exhibition three specimens of *Nonagria Typha*, a rare species of *Noctua*, and new to the Reigate district: they were bred from pupa taken by himself on Earlswood Common.

The President called the attention of the Meeting to the amount of rain which had fallen during the year 1865, amounting to 34·87 inches, exclusive of 6 inches of snow. This is the largest amount of rain registered during the last eight years, except in 1860, when the quantity in inches was 35·76. The greatest amount of rainfall during one month in the same period occurred last October, when 8·03 inches fell. He also alluded to the heavy snow-storm which had just taken place, showing its local character, the south and south-eastern counties of England being chiefly under its influence: the density of the snow causing it to crush down trees and shrubs, particularly ever-

greens, was well worthy of remark. He calculated that the average depth of snow fallen during the storm was about 10 inches.

The President brought for exhibition several insect habitations which he had recently received from Australia, the ingenious construction of which he carefully explained. Besides these habitations, there were exhibited sundry eggs of insects from the same part of the world. One lot of eggs, probably belonging to a Neuropterous insect, were most remarkable; they were laid on long filaments in so peculiar a way as to be quite a puzzle how and why they were so deposited. The eggs were elongate-ovate, in a row, the end of one egg abutting against the middle of the side of the next, so that they stood at right angles to each other. The filaments of the eggs which crossed the direction of the row were vertical, those of the other eggs were in a slanting direction, having an angle of 50 to 60 degrees.

February 9th, 1866.—The President exhibited a large series of specimens of the Common Brake (*Pteris aquilina*) from various parts of the world, showing the great variety that occurs in this species, and called the attention of the Meeting to a specimen in the collection just presented to the Club by Mr. Green, which was remarkable for its extreme delicacy and beauty.

The Secretary stated that, during his recent visit to the Azores, he had observed this beautiful variety of *Pteris aquilina* growing plentifully in an orange garden belonging to Mr. Dabney, the American consul at Horta, in the island of Fayal.

The President exhibited a beautiful species of *Amaryllis* from Southern Africa, obtained by Dr. Walwitsch in the interior of the Portuguese possessions, near St. Paul de Loando. It had large scarlet flowers, with a yellow starlike throat. He also exhibited several plants of the *Oxalis* family, to show the peculiarity of the foliage, differing from purely ternate leaves to those which were pinnate, while in other species the three leaflets soon faded from the leaf-stalk, which, swollen and flattened, then assumed the appearance of an elongate lanceolate leaf. He also explained the peculiarity which *Begonias*, and several other plants, possessed of propagation from the leaf itself. The well-formed leaves, when taken from the plant, have the central rib and some of the main ribs of the leaf

broken in two or more places ; in this state the leaf is laid in a damp hothouse, on sand or very fine gravel, and after a time roots spring from the broken ribs, and plants are soon formed. Specimens illustrating this process were exhibited.

A box containing a fine series of the genus *Heliconia*, from Cayenne, was exhibited by the President, with the object of showing that, in this family of butterflies, markings and colour had little to do with specific differences : red, yellow, and black, seemed to be infinitely varied in the specimens ; and what would probably form seven or eight species, when taken separately, were clearly varieties of the old and well-known *Heliconia Melpomene*.

He then explained and illustrated by a series of specimens, which he placed on the table, the varied characters and peculiarities of the organs of flight in the different families of insects, showing how admirably nature has provided these small creatures with wings suitable to their particular method of life.

March 9th, 1866.—Mr. Watney gave an interesting account of a pair of Cockatoos, which he sent for presentation to the Club at a previous Meeting. The specimens were shot near Dorking ; but whether they had escaped from confinement, or had voluntarily made their way to this country, there is no evidence to show. The species is *Cacatua Eos*, Lees, the Rosebreasted Cockatoo, and is a native of the interior and northern portions of Australia, also of the south of Africa, and is sometimes seen in very large flocks. Mr. Watney read an interesting description of the species from a printed paper which he presented to the Club. It has a peculiar flight, and the whole flock turning together show the rose-colour of the under surface with pretty effect.

The President exhibited a Cucumber leaf from Clifton, near Bristol, which was attacked by a small fungus appearing in minute black round puff-ball looking masses spread over the leaf in many places, which he believed to be a kind of Erysiphe. This minute fungus had been very destructive during the winter months to the forced cucumbers in the neighbourhood of Bristol. He also brought for exhibition a series of Insects obtained from the north island of the Japan Archipelago, which were remarkable for their great simi-

larity to the insects of this country and those of the temperate portions of Europe. Some few appeared identical with our own native species; others were of the same character, but differed in some minute but distinct particulars; while others widely diverged from the temperate type, and here and there were specimens indicating almost a tropical origin.

He also exhibited a fine Goliath Beetle from Western Africa, which seemed intermediate in form and colouring between *Goliathus Cacicus* and *G. Drurii*, and pointing to the probability that the two species named are only varieties of one variable form of *Goliathus*.

The President then exhibited a very beautiful and interesting collection of growing Orchids of various character, in full bloom, which he brought to the Meeting for the purpose of drawing the attention of the Members to the very peculiar nature of the sexual organs of this class of plants. These peculiarities he explained fully, pointing them out by drawings

April 13th, 1866.—The following resolutions, proposed by Mr. E. Chambers, and seconded by Mr. Percival Wright, were passed unanimously:—

“RESOLVED—That the best thanks of the Members of the Holmesdale Natural History Club be given to William Wilson Saunders, Esq., F.R.S., the Founder and President of the Club, for his unceasing interest in its advancement, his personal exertions in its welfare, in devoting so much of his time to the Social Winter Evening Meetings, and the delightful summer rambles, for his readiness at all times to open his valuable collections in Natural History to the Members, for his liberal donations towards their funds, and his numerous contributions to their Museum. They earnestly hope that his valuable life may long be spared to his family and friends, and that he may for many years preside over the Club.

“RESOLVED—That the above Resolution be transcribed on vellum, signed by Thomas Martin, Esq. (Vice-President), and presented to the President.”

The President expressed his warmest thanks to the Members for their very kind feeling towards him, and stated that Natural History

pursuits had always afforded him the greatest pleasure, and that the continued prosperity of the Club would ever be a source of gratification to him, and he felt happy in doing anything in his power to promote its interests.

The President brought for exhibition the nests of some Social Caterpillars from the South of France, *Bombyx (Enethocampa) processionea*, lately procured by Messrs. F. and E. Saunders. They were found suspended from the branches of fir-trees, and were from 6 inches to 12 inches long, purse-like, with a hole in the bottom. Within these nests, which are formed of a rough, silk-like substance, the associated larvæ reside during the night, sallying forth to the branches of the fir-trees for food during the day, and doing much injury. When about near the change from the caterpillar to the pupa state, they leave the nest in procession, and are often seen travelling on the ground, one after the other, in a continued and unbroken line. The caterpillars are then about an inch in length, and the processions extend to some distance. In two processions noticed, the numbers counted were 85 in one and 75 in the other. The caterpillars seem to play a complete game of follow the leader, as it was found that if the line of procession was broken the caterpillars behind the break were thrown into confusion, and no longer continued the line of procession.

He also exhibited a fine specimen of *Gordius aquaticus*, a thread-like worm found in water, often measuring several inches in length, and moving about in the fluid in a graceful wavelike motion of the body. It is supposed to have no injurious effect on the water in which it is found.

He also brought for exhibition some fine specimens of *Peziza*, recently obtained from under fir-trees, near Chipstead. This fine species of fungus is rare, and has not been previously noticed in this district. It has appeared in several places round London this spring, and always under the shade of trees of the fir tribe.

The President drew the attention of the Members to some curious specimens of roots obtained recently from drain-pipes at Fetcham. The tube of the pipes had been entirely choked with the fibrous roots of the ash, even when the diameter of the tube was 6 inches. In-

stances of alder roots filling drain-pipes in the same way have been previously before the Club.

The President then made a series of observations on the imitative principle often set up among the insect tribes in various stages of insect existence. He instanced the very close resemblance of some Moths to Butterflies, both in shape and colour; the same as regards Moths and Hymenoptera of the Wasp tribe; also as regards Flies, the true Diptera, and Hymenoptera of the Bee tribe. Some of these resemblances were so close that it required a practised eye to see the differences. Caterpillars, again, often closely resembled dried sticks; Moths, dead leaves; the Locust tribe, both the living and the dead leaves. Indeed, the resemblances were very frequent, and the subject one of much interest. The President stated his intention of again touching on the subject and going into further details.

ANNUAL GENERAL MEETING, *July 20th, 1866.*

The Secretary read the Annual Report for the past year, showing the present state and prospects of the Club and the progress that had been made in investigating the natural productions of the neighbourhood.

The Treasurer read his Financial Report for the year, by which it appears there is a balance in hand of *5l. 14s. 3d.*

Resolved, that both Reports be adopted and printed, and sent to all the Members and Subscribers.

The following gentlemen were elected Officers and Committee for the ensuing year:—

President—W. WILSON SAUNDERS, F.R.S.

Vice-Presidents—THOMAS MARTIN and C. HOLMAN, M.D.

Treasurer—PERCIVAL WRIGHT.

Secretary—JAMES ALEXANDER BREWER.

Curator—JOHN LINNELL, jun.

Other Members of the Committee.

ELIJAH CHAMBERS.

JOHN LEES.

THOMAS HART.

B. R. C. ROUSE.

SYDNEY WEBB.

A vote of thanks was unanimously passed to the Officers and Committee for the past year, for their labours in promoting the interests of the Club.

In accordance with a Resolution passed at the Meeting of the 13th of April last, the Address to the President has been transcribed on vellum, signed by Mr. Thomas Martin, Vice-President, on behalf of the Members of the Club, and was now presented to the President.

The President again thanked the Members for this proof of their very kind feeling towards him, and expressed his wish that the Club might long continue to increase in prosperity and usefulness, and be the means of promoting a greater love for Natural History pursuits in this neighbourhood.

He then briefly alluded to the proceedings of the Club during the past year, especially alluding to the Field Meetings, and called the attention of the Meeting to some of the chief objects of interest observed on those occasions.

FIELD MEETINGS.

August 5th, 1865.—On this occasion the Members proceeded by train to the Hassock's Gate Station on the London and Brighton Railway, and walked thence to Hurstpierpoint and on to Dr. Holman's farm at Albourne, where they were kindly invited to dine. During the walk, and just after leaving Hurstpierpoint for Albourne, *Œnanthe crocata*, *Epilobium hirsutum* and *Scrophularia aquatica* were observed on the side of a small stream or ditch, in unusually fine condition; and a little further on, in the same stream, *Lemna minor* was observed in flower; also *Ranunculus sceleratus* of unusually large size. Still further on in the lane a species of *Mentha* was met with which appeared to be *M. piperita*; and in a corn-field near at hand were noticed a great number of the usual annual corn weeds, and especially a large quantity of *Rhaphanus Raphanistrum*.

October 7th, 1865.—The Members made this day a very pleasant excursion to Leith Hill, lunching at Cold Harbour. During the walk from Dorking to Leith Hill, through the sandy lanes, the attention of the Members was frequently called to the nature and growth of the roots of trees; the sand of the steep banks washing away having left them bare for many feet in length in several places. It was very evident that roots often anastomise, or become grafted one on to the other, sometimes forming a complicated network. Seeing how very seldom the branches of trees anastomise, this operation among the roots was the more striking.

Several instances of plants, usually green in colour, becoming partially variegated with white or yellowish white, were observed, among which the common dock, *Rumex obtusus*, and the common wood sorrel, *Oxalis Acetocella*, may be mentioned as being most marked. This tendency to become variegated might, by judicious management under cultivation, be the basis of considerable change in the colours of the leaves. The black briony, *Tamus communis*, was observed with the whole of its leaves of a purplish black colour.

The views from the higher ground were very beautiful, and the deep blue colour of the sky, when seen from under the shade of some fir-trees and in a direction with the back to the sun, was very remarkable : it seemed to have a depth and transparency of tint which was very striking. The entomologists and botanists obtained many interesting specimens both of insects and plants, but nothing to remark particularly, as the Members of the Club had gone nearly over the same ground before.

May 19th, 1866.—The Members of the Holmesdale Natural History Club made an excursion to Shalford, and walked from there to Black Heath and back.

Shalford Common offers several interesting plants, among which may be mentioned *Moenchia erecta*, *Myosotis collina*, and *M. versicolor*, *Pedicularis sylvatica*, var. with white flowers, *Nardus stricta*, &c. &c.

In the sandy lane leading from the east portion of the common to Black Heath, *Glechoma hederacea* was noticed with a very long straggling habit ; *Arabis thaliana*, very tall ; *Viola sylvatica*, and the usual plants of such localities.

Higher up, near the Down, in open copses, *Bunium flexuosum* was noticed in great abundance and very fine, a number of its tubers were dug out of the ground, and the Members seemed to relish their nutty flavour. Here, on sandy banks, was observed *Teesdalia nudicaulis*, and on an open grassy spot some fine specimens of *Botrichium lunaria* were found in good condition, and the bright *Vicia angustifolia* in full flower. *Spergula arvensis* appears to be a very troublesome weed in the light sandy fields in this neighbourhood, in places literally covering the soil as if it had been cropped with it. The common broom and the holly grow very fine near the Down, and one very large rounded bush of the latter attracted the attention of the Members from the quantity of flowers on it, and the busy hum of insects sucking sweets from its blossoms.

Many rare and interesting species of Coleoptera were captured on this occasion, among which the following are especially worthy of note :—*Anisodactylus atricornis*, from the margins of a small pond near Shalford Common ; *Haploglossa pulla*, and *Celiodes subrufus*,

beaten from oak trees, on Black Heath; *Bruchus villosus*, from the flowers of broom; *Omalium florale*, from a sand-pit near Black Heath; *Ceuthorhynchus inornatus*, *C. quercicola*, and *Hyperaspis reppensis*, taken by sweeping near Black Heath.

July 20th, 1866.—On this occasion the Members proceeded to Greening's Farm, Charlwood, by the kind invitation of the President. The weather was fine, the attendance of members larger than usual, and the excursion altogether a very pleasant one; the only cause of regret was the absence of the President, who was too unwell to meet the Members, but whose place was supplied by two of his sons.

The following are a few of the plants noted as occurring there:—*Epipactis purpurata*, *Hypericum Androsæmum*, *Serratula tinctoria*, *Angelica sylvestris*, &c., in the woods at Greening's Farm; *Lathyrus Nissolia*, on the borders of fields; *Tilia parvifolia*, *Pyrus domestica*, *P. torminalis*, &c., in hedge-rows; and *Euphorbia platyphylla*, *Bupleurum rotundifolium*, *Lotus tenuis*, &c., in corn-fields.

Many interesting captures were made by the entomologists, both in Lepidoptera and Coleoptera. Among the latter, perhaps the following are worthy of note:—*Gyrophana nana* and *G. affinis* were taken in profusion from fungi in the woods; *Conopalpus testaceus* was beaten from oak-trees; *Magdalinus Pruni*, beaten from *Prunus spinosa*; and *Eriirhinus tæniatus* and *E. pectoralis* beaten from willows.

NINTH ANNUAL REPORT
OF THE
HOLMESDALE NATURAL HISTORY CLUB.

JULY, 1866.

THE Committee of the Holmesdale Natural History Club, in presenting their Ninth Annual Report, have much pleasure in congratulating the Members on its present condition and increasing prosperity.

During the past year 15 new Members have been elected, 3 Subscribers, and 1 Corresponding Member, making a total of 19. A few resignations have been received, but the number of Members and Subscribers now amounts to about 150.

The Club have, during the past year, had to lament the death of their late highly-esteemed Treasurer, Mr. Andrew Sisson, who had kindly and efficiently filled that office since the establishment of the Club in 1857, and whose loss is felt by all who knew him. The Committee have requested Mr. Percival Wright to fill the vacancy until the Annual Meeting, when they hope he will allow himself to be elected Treasurer of the Club.

The following donations to the Library and Museum have been received during the year:—

Reprints of 'Reports of the British Association held at Bath in 1864;' presented by Mr. Thomas Martin.

A fine specimen of the Spotted Emeu (*Dromeus irroratus*), bred and reared at Brockham; presented by Mr. William Bennett.

Three fine specimens of the Death's Head Moth ; presented by the President.

Fossil specimens of *Choanites Konigii*, from the chalk flints of the Isle of Wight ; presented by the Secretary.

A fine specimen of Iron Pyrites from Dartmoor ; presented by Mr. Shirley Woolmer.

Framed and glazed Portraits of the late Dr. Lindley and Sir Joseph Paxton ; presented by Mr. Thomas Martin.

A specimen of the Nuthatch ; presented by the late Mr. Sisson.

A fine specimen of a Lichen (*Parmelia caperata*), from an oak tree in Normandy ; presented by Mr. Steele.

<p>'Geodephaga Britannica,' by Rev. J. F. Dawson ; 'Entomologist's Annual for 1857' ; 'Journal of the Proceedings of the Linnæan Society,' Nos. 28 to 34 on Botany ; _____ Nos. 28 to 30 on Zoology ;</p>	} presented by the President.
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A pair of the Rosebreasted Cockatoo (*Cacatua Eos*), a native of the interior and northern portions of Australia. These specimens were shot near Dorking ; presented by Mr. Watney.

A small collection of Minerals, chiefly tin, copper, iron and quartz ; presented by Mr. Lees.

A collection of the British Ferns and their Allies, almost complete ; presented by Mr Green.

A collection of British Mosses, containing a large proportion of the Reigate species, collected by Dr. Henry Martin Holman ; presented by Dr. J. A. Power.

'The Surrey Archæological Collections,' vol. iii. ; presented by the Surrey Archæological Society through Mr. Austin.

A Black Board, with Stand ; presented by Mr. Chambers.

Very great attention still continues to be paid by several of the Members to the Coleoptera of the district, which has resulted during the past year in the addition of 28 species to the Fauna of this neighbourhood, one of which is a species new to Britain, and was taken by Dr. Power at Mickleham (*Borboropora Kraatzii*, Fuss.), and is unique in his collection ; and another species, *Oxyopoda glabriventris*,

Rye, a species new to Science, also taken by Dr. Power, at Mickleham, from a nest of *Formica fuliginosa*.

Four excursions have been made by the Members of the Club during the past year for the purpose of investigating the natural productions of the district, during which many interesting specimens of Natural History have been collected, chiefly in plants and insects, and much valuable information has been obtained.

HOLMESDALE NATURAL HISTORY CLUB, IN ACCOUNT WITH THE TREASURER.

1865-66.

Amount of Subscriptions received
for the year, July 1865-66 ...
Ditto, for Arrears ...
Received of Mr. Linnell for Boxes
Ditto of Mr. W. W. Saunders,
Donation towards Rent ...

26 0 6
1 10 0
1 5 0
7 10 0

1865.

Aug. 7. Balance due to Treasurer from
last year ...
Mr. S. Webb for Stamps ...
Oct. 3. Account Books from Waterlow's
Nov. 9. Paid Allwork for Camphor ...
Public Hall—Rent, Gas, &c., to
Midsummer last ...

3 17 0
0 5 0
0 19 0
0 5 0
9 3 1

1866.

Mar. 10. Public Hall—Rent, Gas and
Firing to Christmas, 1865 ...
Paid to Mr. J. A. Brewer for
Postage Stamps and Sundries,
1864-66, as per Account ren-
dered: ...

7 17 1
6 4 6

July 27. Paid to S. Brewer for Books and
Stationery, 1864-65 ...
Balance in hand this day ...

2 0 7
5 14 3

£36 5 6

£36 5 6

RULES.

NAME.

I.—The Association shall be styled "THE HOLMESDALE NATURAL HISTORY CLUB."

OBJECTS.

II.—The investigation of the Natural History of Reigate and its vicinity, and the mutual improvement of its Members in the study of Nature.

CONSTITUTION.

III.—The Club shall consist of Members, Subscribers, Corresponding Members, and Honorary Members.

MEMBERS.

IV.—Members shall be elected by ballot or show of hands at any Ordinary Meeting. The candidates to be recommended by one or more members at any Ordinary Meeting, and the election to take place at the Meeting next ensuing.

SUBSCRIBERS.

V.—Subscribers shall be elected in the same manner as Members, and shall have all the privileges of Members, except of holding any office in the Club, or of voting upon any matter connected therewith, or of having any right or ownership in the property of the Club.

CORRESPONDING MEMBERS.

VI.—It shall be competent for the Club to elect as Corresponding Members any gentlemen distinguished for their attainments in Natural History, either as collectors or authors, or to whom the Club may be indebted for contributions of papers or specimens; such Corresponding Members to have similar privileges to Subscribers, without payment, and to be elected by the Club upon the nomination of the Committee.

HONORARY MEMBERS.

VII.—Honorary Members shall be elected by the Club upon the nomination of the Committee, and shall be exempted from the payment of subscriptions, and shall have the privileges of Subscribers.

OFFICERS.

VIII.—The Club shall, at the Annual General Meeting, elect from among themselves a President, Treasurer, Secretary, Curator, and seven Members to form a Committee of Management, three of whom to form a quorum.

VICE-PRESIDENTS.

IX.—The President shall nominate annually two Vice-Presidents from the Members of the Committee.

 MEETINGS, &c.

ANNUAL GENERAL MEETING.

X.—This Meeting shall be held on the second Friday in July, when the Committee shall present a Report detailing the general state, proceedings, and pecuniary condition of the Club, and proceed to the election of officers.

SPECIAL MEETINGS.

XI.—The Committee shall have the power to call a Special General Meeting at any time; and they shall do so within four weeks after receiving requisition to that effect, signed by at least five Members. The notice calling the Meeting shall state the objects for which the Meeting is called, and no other business shall be transacted.

ORDINARY MEETINGS.

XII.—These shall be held on the second Friday in every month, from October till April, inclusive, or more frequently at the option of the Committee.

SUBSCRIPTIONS.

XIII.—Each Member shall pay to the Treasurer Ten Shillings on his election, and the same sum at the Annual General Meeting each year; but may compound for such annual subscription by payment of Five Pounds. Each Subscriber shall pay to the Treasurer Five Shillings on his election, and the same sum at the Annual General Meeting each year. The name of no Member or Subscriber shall remain on the books of the Club who is in arrear for twelve months.

NEW RULES.

XIV.—Any five Members wishing to propose a new Rule, or the omission or alteration of any existing Rule, must send notice to the Secretary, who shall, within a month, call a Special General Meeting to consider the change proposed.

LIBRARY AND COLLECTIONS.

XV.—The Club shall form, as opportunity may offer, a Library of Reference, consisting of Works bearing on the subject of Natural History; and obtain Collections of the natural objects of the neighbourhood. The Library, Collections, and Funds to be the property of the Members for the time being, and shall be vested in Trustees

for the use of the Members. Contributions of Life Members shall also be invested in the names of such Trustees in such manner as the Committee may direct, the interest arising therefrom to be handed to the Treasurer for the general purposes of the Club.

ELECTION OF TRUSTEES.

XVI.—The Trustees shall consist of the President for the time being, and three other Members to be elected by the Club.

LIST OF MEMBERS AND SUBSCRIBERS.

Names marked (*) are Honorary Members.

Names marked (+) are Corresponding Members.

- ALEXANDER, Rev. A. B., Redhill
ALLINGHAM, WILLIAM, Reigate
ALLWORK, FRED., Station-road, Redhill
APTED, JAMES, Reigate
AUSTIN, EDWARD VAUGHAN, Reigate Hill

BAKER, GEORGE, Reigate
*BARCLAY, ARTHUR K., Bury Hill, Dorking
BATCHELOR, J. G., Reigate
BATTERBEE, JOSEPH, Reigate Hill
BAXTER, ROBERT C., Wray Park, Reigate
BENNETT, WILLIAM, Brockham
BOSSEY, Dr., Oxford-terrace, Redhill
BENNS, S., P. Major's, Reigate Hill
BREWER, JAMES ALEXANDER, Reigate
BRITTEN, BASHLEY, North Vale, Redhill
BROWN, JOHN, Earlswood, Reigate
BUDDEN, FRED., Reigate
BURNETT, J. R. F., Vauxhall, S.
BURNINGHAM, Rev. THOMAS, Charlwood
BYASS, R. NICOLL, Wray Park, Reigate

CALVERT, JOHN, 189, Strand, London
CARRUTHERS, WILLIAM, Reigate
CAZENOVE, Rev. A., Wray Park, Reigate

CHAMBERS, ELIJAH, Wray Park, Reigate
 CHEAL, CHARLES, Bell-street, Reigate
 CLUTTON, ROBERT, Hartswood, Reigate
 COOKE, E. W., The Ferns, Hyde-park Gate, South Kensington, W.

COOPER, GEORGE, Craydon
 COOPER, THOMAS, Holmesdale-road, Reigate
 CORNTHWAITE, Rev. T., Walthamstow, Essex
 CUMMINS, Rev. H., Wildecroft, Betchworth
 CURLING, CHARLES, Clapham Common, S.
 CURZON, The Hon. SIDNEY ROPER, Grove House, Tooting, S.

DAVIDSON, CHARLES, Redhill, Reigate
 DEMATTOS W. T., Reigate Hill
 DOSSETER, E., Wray Park, Reigate
 DOWN, J. LANGDON, M.D., Earlswood Asylum, Redhill

ECKSTEIN, FRED., 10, Princes-square, Bayswater, W.
 ECKSTEIN, JOHN, 2, Woodfield-place, Harrow-road, W.
 *EVELYN, W. J., Wotton, near Dorking

FORBES, WILLIAM, Reigate
 FOWLE, HENRY, Station-road, Redhill
 FREEMAN, FRANK, Reigate
 FRENCH, EDWIN, Reigate

GILMAN, WILLIAM, Wray Common, Reigate
 GOOCH, Rev. JOHN, Grammar School, Reigate
 GOODCHILD, GEORGE, Reigate
 GORE, Rev. HENRY, Rusper, Sussex
 GOWER, G. LEVESON, Titsey-place, Godstone
 GREEN, CHARLES, Reigate Hill
 GREEN, HERBERT, Reigate
 GRITTON, JOHN WILLIAM, Mead Hill, Redhill
 GRITTON, WILLIAM, Mead Hill, Redhill
 GULLIVER, GEORGE, F.R.S., Edenbridge

HALLOWES, F. B., Reigate
 HANBURY, PHILIP, Woodlands, Redhill
 HART, THOMAS, Reigate
 HAWKES, Rev. S. J., Guildford
 HAWKINS, SYDNEY, Wray Park, Reigate
 HEAWOOD, JAMES, 4, Carlton Villas, Upper Sydenham
 *HILL, CHARLES, West Hoathley, Sussex
 HOARE, Rev. G. T., Tandridge
 HOLMAN, CONSTANTINE, M.D., Reigate
 HOLMAN, Mrs., Reigate
 HUDSON, ROBERT, Clapham Common, S.

KELSEY, A., Wray Park, Reigate
 KLEIN, WILLIAM, The Rock, Reigate Hill
 KLEIN, Mrs. WILLIAM, The Rock, Reigate Hill
 KLEIN, WILLIAM, jun., The Rock, Reigate Hill
 KNAPP, I., P. Major's, Reigate Hill

LAINSON, HENRY, Heath House, Reigate
 LANE, FRANCIS, Holmesdale-road, Reigate
 LEES, JOHN, Reigate
 LEES, Rev. W., Sidlow Bridge, Horley
 LINNELL, JOHN, jun., Redstone, Reigate
 LINNELL, THOMAS, Redstone, Reigate
 LOAT, CHRISTOPHER, Furze Hill, Redhill
 LOAT, WILLIAM, Furze Hill, Redhill
 LUBBOCK, Sir JOHN, Bart., 15, Lombard-street, London, E.C.

MAJOR, PRICE, Reigate Hill
 M'CUTCHAN, WILLIAM, Holmesdale-road, Reigate
 MARKHAM, JOHN, Reigate
 MARKHAM, JOHN, jun., Reigate
 MARKHAM, EDWARD N. D., Reigate
 MARTIN, HENRY CHARRINGTON, Reigate
 MARTIN, THOMAS, Reigate
 MASON, SAMUEL, Earlswood, Redhill

MATHEWS, J. F., Reigate Hill
 MELLERSH, FREDERICK, Reigate
 MEIKLE, WILLIAM, Park-lane, Reigate
 MORLAND, THOMAS, Reigate Hill
 MORRISON, GEORGE CARTER, Reigate
 MUMMERY, J. R., 10, Cavendish-place, Cavendish-square
 MUMMERY, JOHN HOWARD, 10, Cavendish-place, Cavendish square

NEWCOMBE, S. PROUT, Westfield, Reigate Hill
 NICHOLS, JAMES, Reigate
 NICHOLSON, JAMES, Salmon's Cross, Reigate
 NICKALLS, SMITH, Reigate
 NICKALLS, THOMAS, Reigate
 NORTH, THOMAS, Wray Common, Reigate

PAINÉ, WILLIAM DUNKLEY, Cockshot Hill, Reigate
 PAWLE, FREDERICK, Wray Park, Reigate
 PAYNE, JOHN, Reigate
 PEARSON, JONATHAN, High-street, Notting Hill
 PHILLIPS, JAMES, Claremont Lodge, Brixton
 PHILLIPPS, WILLIAM, Reigate Lodge
 PHILLIPPS, MRS. WILLIAM, Reigate Lodge
 POOLE, H. T., Wray Park, Reigate
 PONTIFEX, —, Park Mead, Reigate
 †POWER, J. A., M.D., 52, Burton-crescent, London, W.C.
 PROUT, Rev. E., Wray Park, Reigate

QUINTON, OLIVER, Warwick Town, Redhill

READ, ROBERT, Reigate
 RELF, SAMUEL, Reigate Hill
 RELF, MRS. SAMUEL, Reigate Hill
 RICHARDSON, GEORGE, jun., Garlands, Redhill
 ROBERTS, T. VAUGHAN, 1, Brick-court, Temple, London
 ROSLING, ALFRED, Reigate Hill

ROUSE, B. R. C., Warwick Lodge, Redhill
 ROUSE, W. B. C., Warwick Lodge, Redhill
 ROWSELL, Rev. T. N., Reigate

SAUNDERS, EDWARD, Hillfield House, Reigate
 SAUNDERS, GEORGE, Hillfield House, Reigate
 SAUNDERS, HOWARD, Oakfield, Reigate Hill
 SAUNDERS, W. F., Hillfield House, Reigate
 SAUNDERS, W. WILSON, F.R.S., Hillfield House, Reigate
 SAUNDERS, Mrs. W. WILSON, Hillfield House, Reigate
 SEARLE, JAMES, Furze Hill, Redhill
 SMEE, General, Reigate
 SMITH, C. J., Reigate
 SMITH, Rev. C. T., Reigate
 SOPER, WILLIAM, 1, St. George's Villas, Stockwell-road
 STEELE, FRANK LOCKE, Reigate
 STEELE, JOHN SISSON, Reigate
 STEELE, RUSSELL, Reigate
 STENNING, WILLIAM, Station-road, Redhill
 STREET, Miss, The Retreat, Reigate

THOMSON, WILLIAM, Buckhurst, Redhill
 THORNTON, WILLIAM, Reigate
 THURNAM, EDWARD, Reigate
 TYNDALL, W. H., Oxford-road, Redhill

VAN CORTLANDT, —, Reigate Hill

WALKER, C. V., Redhill
 WALTERS, JOHN, M.D., Reigate
 WALTON, THOMAS ISAAC, Alberry House, Old Kent-road
 WATNEY, DANIEL, Poultry, London
 WEBB, ALFRED, Redstone Manor House, Redhill
 WEBB, ASTON, Redstone Manor House, Redhill
 WEBB, HENRY, Redstone Manor House, Redhill
 WEBB, SYDNEY, Redstone Manor House, Redhill

WEBB, WALTER, Redstone Manor House, Redhill

WESLEY, HENRY, Redhill

WESTWOOD, THOMAS EDWARD, Reigate

WOLLASTON, FRANK, Dovers, Reigate

WOLLASTON, Rev. THELWALL, Dovers, Reigate

WOOLMER, SHIRLEY, Dorking

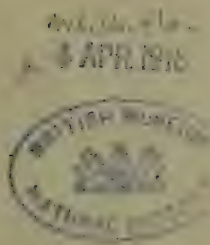
WRIGHT, PERCIVAL, Wray Park, Reigate

WRIGHT, THOMAS HOWARD, Wray Park, Reigate

WRIGHT, Rev. T. P., Wray Park, Reigate

WINTER, Rev. J. C., Gatton Tower

YOUNG, G. F., Wray Park, Reigate





PROCEEDINGS

OF THE

Reigate
Holmesdale Natural History Club,

REIGATE,

FOR THE YEAR 1866-67.

LONDON:

PUBLISHED FOR THE HOLMESDALE NATURAL HISTORY CLUB, REIGATE,
BY JOHN VAN VOORST, 1, PATERNOSTER ROW.

Price One Shilling.

PROCEEDINGS
OF THE
HOLMESDALE NATURAL HISTORY CLUB.

EVENING MEETINGS.

October 12, 1866.—The Secretary exhibited the following sixteen species of Coleoptera, all taken by himself since the April Meeting of the Club, and new to the Reigate district:—

Homalota hepatica, Er. From moss, near Three Bridges.

Colon serripes, Sahlb. From Shirley sand-pit.

„ *viennense*, Herbst. Sand-pit near Dorking.

Rhizophagus cribratus, Gyll. Sand-pit near Dorking; and from a dead oak tree near Three Bridges.

Helodes marginata, Fab. Beaten from hedges near Three Bridges.

Cis festivus, Panz. Beaten from an oak tree near Three Bridges.

Ennearthron affine, Gyll. From Boleti near Reigate Heath.

Lissodema 4-guttatum, Lep. et Serv. Beaten from hedges near Reigate Heath.

Cneorhinus exaratus, Marsh. Sand-pit on Reigate Heath.

Alophus triguttatus, Fab. Sand-pit near Dorking; and on palings near Mickleham.

Tychius venustus, Fab. Beaten from broom, Shirley Common.

„ *Meliloti*, Kirby. From *Melilotus officinalis*, below Reigate Hill.

Sibynnes arenaria, Kirby. Sand-pit on Reigate Heath.

Anoplus plantaris, Næz. Beaten from birch trees near Three Bridges.

Bagous lutulentus, Gyll. Sand-pit near Dorking.

Gonioctena 10-punctata, Linn. Beaten from an oak tree near Three Bridges.

The President brought for exhibition a double apple, grown this year at Greening's Farm, Charlwood. The fruit had one ordinary well-formed foot-stalk, bearing two apples joined together, each with a distinctly developed crown: the fruit was full sized, and had arrived at a state of maturity. (See Plate I. f. 1.)

He also exhibited some specimens of the climbing *Polygonum dumetorum*, lately obtained at Chilworth, to show the difference between this species and *P. Convolvulus*, specimens of which were also placed on the table. The two plants having much the same habit and general appearance are frequently misunderstood; but the elongate strongly-winged seed-vessel of *P. dumetorum* is a good mark of distinction.

The President exhibited three very remarkable Orchids, in flower, belonging to the genera *Catasetum*, *Myanthus* and *Acropera*, to show that, however unlike the flowers might appear, yet their structure was the same, and that the plants bearing them had a close family alliance.

He placed on the table a very long shoot of the present year's growth of *Rosa sempervirens*, to show how vigorous the plant is under ordinary cultivation: this species of Briar or Rose, from the Himalaya Mountains, is quite hardy, producing large bunches of single white flowers, and may prove very useful for a stock to bud the improved varieties of the rose upon.

The President exhibited an Angle Shade Moth (*Phlogophora meticulosa*), which, having recently escaped from the chrysalis, was captured and killed by a small house spider. The moth had been perceived, late one evening, in fine condition, sitting on the ledge of a window; the next morning it was again observed, but in a very altered condition, and with the small spider attached to the fore part of the thorax. The moth was quite dead, and the spider so intent

on its work of destruction that although it was removed from the moth it immediately returned to its prey, and was only driven off by force. He also related the circumstance of a small spider taking a very minute fly which had fallen into its web, which was constructed in the side-window of a first class railway carriage. During the progress of the train, and while the carriage was in considerable motion, the occurrence took place, from which it may be inferred that the spider *saw* the fly as soon as it touched the web, and that it was not attracted to it by the motion set up by the fly on the web.

The President then drew the attention of the Meeting to a series of plants placed on the table, with a view of showing the botanical nature of the fruit of the common Fig, and the close affinity there is between the Fig, the Mulberry, *Dorstenia* and Nettles, however different they may be in general appearance.

November 9, 1866.—The Secretary brought for exhibition a specimen of *Homalota Saundersi*, Rye, a species new to Science, and named after the President of the Club. It was captured by himself (with one other specimen which was accidentally destroyed) in the sand-pit on Reigate Heath, in August last. The following is from Mr. Rye's description of this insect (*Ent. Monthly Magazine*, vol. iii. p. 121):—" *Homalota Saundersi* appears to be very closely allied to *H. dilaticornis*, Kraatz.; the general structure of the two insects, and especially that of the antennæ (except that the apical joint is a trifle longer in *H. Saundersi*), being almost identical; it differs, however, from that species, in its rather larger size, darker colour and more strongly punctured elytra; and in the sexual characters the male of *H. Saundersi* having the teeth on the sides of the sixth abdominal segment longer and more robust, reaching, at their points, slightly beyond the two tubercles in the middle of the upper surface of the same segment, which tubercles assume the form of wide and apically truncated tooth-like elevations, projecting beyond the apical margin. (See Plate I. fig. 3).

Mr. John Linnell, jun., brought for exhibition the following six species of *Cercyon*, all captured by himself and his brother.

Mr. Thomas Linnell, and not previously recorded as occurring in the Reigate district:—

Cercyon obsoletum, Gyll. Captured at Redhill.

„ *hæmorrhoidale*, Fab. Redhill.

„ *laterale*, Marsh. Redstone.

„ *flavipes*, Fab. Redstone.

„ *quisquilius*, Linn. In dung, Redstone.

„ *nigriceps*, Marsh. Reigate district.

The President again brought forward the subject of the double apple exhibited by him at the last Meeting. He now showed a section of it, by which it appears that there were two well-formed cores, with ripened pips, proceeding from one footstalk. (See Plate I. fig. 1.)

He exhibited a large and beautiful moth from Sierra Leone, of great rarity; its expansion of wings was about six inches; colour fawn, with a large eye-like spot on each of the hind wings.

He also exhibited a beautiful specimen of the delicately formed white fungus, *Squamaria alba*, growing on *Trifolium arvense*, &c., obtained from the sand-hills at Deal by Mr. Frederick Smith, of the British Museum.

Also a small collection of Centipedes, from various localities, with a view to point out the remarkable characters of one species, which he had recently received from Natal. This, instead of the usual jointed tapering processes arising like horns from the last joint of the body, had long spoon-like processes of the same number of joints, but very remarkable in shape.

The President then drew the attention of the Meeting to a collection of Begonias placed on the table, consisting of many varieties and species. His object was to show how the numerous varieties of this genus of plants, so much admired for the beauty and markings of their leaves, had originated, and how further varieties might be obtained. He stated that the species called *Rex rubrovenia* and *R. xanthina* were the parents of most of the varieties which met with so many admirers, and had been obtained by judicious crossings between them. He observed that, however beautiful these varieties

were, yet he thought if some of the species on the table were examined, plants unchanged by the art of man, they would be found more worthy of cultivation for habit of plant, beauty of foliage and charm of flowers than any of the larger-leaved varieties so much in fashion among cultivators.

The President also exhibited some very vigorous shoots of elm which had sprung up this year at Greening's Farm, Charlwood, from stumps of trees which had recently been cut down: the shoots measured ten feet in length, having leaves eight inches long and about five inches wide.

December 14, 1866.—Mr. John Linnell, jun., brought for exhibition the following species of British Hemiptera, 100 in number, captured by himself and his brother, Mr. Thomas Linnell, in the Reigate district, being the first portion of the list of Reigate Hemiptera:—

Scirius bicolor, Linn. Redstone, beating and sweeping, and under stones.

„ *biguttatus*, Linn. Redstone, under stones and in sand-pits.

„ *albomarginatus*, Fab. With the preceding.

Corimelana Scarabæoides, Linn. Buckland Hill, roots of grass.

Eurygaster maurus, Linn. Redstone fields, under stones.

Æliodes inflexa, Wolff. Redstone.

Podops inunctus, Fab. Redstone, under stones.

Pentatoma Baccarum, Linn. Redstone, from broom.

„ *dissimile*, De G. Redstone, &c.

Zicrona cærulea, Linn. Chalk Hills, sweeping.

Picromerus bidens, Linn. Reigate Hill, beating.

Tropicoris rufipes, Linn. Redhill and Reigate.

Piezodorus purpureipennis, De G. Redstone, beating.

Acanthosoma griseum, Linn. Mickleham Downs, beating.

„ *hæmorrhoidale*, Linn. Buckland and chalk hills, beating.

Coreus hirticollis, Fab. Redstone fields, beating; and on houses, Reigate.

- Corizus capitatus*, Fab. Reigate district.
- Stenocephalus agilis*, Scop. Redstone, under stones.
- Eremocoris erraticus*, Fab. Redstone.
- Scolopostethus pictus*, Schill. Reigate district.
- „ *adjunctus*, Doug. & Scott. Redhill, under stones,
&c.
- „ *affinis*, Schill. Redhill Common, roots of grass.
- „ *contractus*, H.-Sch. Buckland Hill, Reigate
Tunnel and on houses, Reigate.
- Peritrechus luniger*, Schill. Reigate district.
- „ *nubilus*, Fall. Roots of grass, Buckland Hill and
Tilgate Forest.
- Trapezonotus agrestis*, Panz. On houses, Reigate; roots of
grass, Redhill.
- Drymus sylvaticus*, Fab. Marshy ground, Redhill, roots of grass.
- Rhyparochromus dilatatus*, H.-Sch. Sand-pits, Reigate Heath.
- „ *antennatus*, Schill. Reigate district, sweeping.
- Hypnophilus hemipterus*, Curt. Redhill Common, roots of grass.
- Plinthisus brevipennis*, Lat. Sand-pit, Reigate Heath; and
Redhill Common.
- Stygnocoris sabulosus*, Schill. Roots of grass, Redhill and Til-
gate Forest.
- „ *arenarius*, Hahn. Sand-pit, Reigate Heath.
- Acompus rufipes*, Wolff. Redhill.
- Cymus glandicolor*, Hahn. Redhill, bottoms of haystacks, &c.
- Monanthia simplex*, H.-Sch. Redstone.
- „ *Cardui*, Linn. Redhill.
- „ *ampliata*, Fieb. Reigate district.
- Derephysia foliacea*, Fall. Reigate district, moss.
- Dictyonota strichnocera*, Fieb. Reigate district, moss.
- Campylostira brachycera*, Fieb. Sand-pit, Redstone Hill.
- Orthostira concinna*, Fieb. Redhill.
- „ *obscura*, H.-Sch. Sand-pit, Redstone Hill.
- Aneurys laevis*, Fab. Sand-pit, Redstone Hill.
- Aradus depressus*, Fab. Redhill, sweeping; and on houses,
Reigate.

- Monalocoris Filices*, Fab. Reigate district, sweeping.
Pithanus Markeli, H.-Sch. Sand-pit, Wray Park.
Minis lævigatus, Linn. Redstone Hill, sweeping.
 „ *calcaratus*, Fall. Redstone fields, sweeping.
Lopomorphus dolobratus, Linn. Redhill and Reigate, sweeping.
Phytocoris divergens, Meyer. Oakfield, Reigate, beating.
 „ *Ulmi*, Linn. Oakfield, Reigate, beating.
Deræocoris striatellus, Fab. Redhill and Reigate.
 „ *bipunctatus*, Fab. Redstone Hill, sweeping.
 „ *sexguttatus*, Fab. Redhill, sweeping.
 „ *binotatus*, Fab. Earlswood, sweeping.
 „ *ferrugatus*, Fab. Reigate district, sweeping.
Pantilius tunicatus, Fab. Redhill.
Byrsoptera Caricis, Fall. Sand-pit, Redstone.
Phylus palliceps, Fieb. Reigate district.
 „ *melanocephalus*, Linn. Reigate district.
Globiceps flavonotatus, Wolff. Redstone hill, sweeping.
Cyllocoris histrionicus, Linn. Redstone Hill, sweeping.
Hoplomachus Thunbergii, Germ. Reigate district.
Psallus distinctus, Fieb. Redstone, sweeping.
Heterocordylus tibialis, Hahn. Redstone, sweeping.
Heterotoma merioptera, Scop. Oakfield, Reigate, beating.
Rhopalotomus ater, Linn. Redstone Hill, sweeping.
Capsus capillaris, Fab. Redhill, sweeping nettles.
Charagochilus Gyllenhalii, Fall. Redhill.
Liocoris tripustulatus, Fab. Redhill, sweeping.
Orthops Kalmii, Linn. Redhill, sweeping.
Lygus campestris, Linn. Redhill, sweeping.
Pæciloscytus unifasciatus, Fab. Near Headley Lane, sweeping, &c.
Harpocera thoracica, Fall. Reigate district.
Lopus gothicus, Linn. Sand-pit, Reigate Heath.
Halticocoris pallicornis, Fab. Near Headley Lane, sweeping.
Zygonotus Pselaphiformis, Curt. Redhill.
 „ *elegantulus*, Barens. Redstone.
Temnostethus lucorum, Fall. Redhill.
 „ *pusillus*, H.-Sch. Redhill.

- Anthocoris nemorum*, Linn. Sandy places, Redhill.
 „ *nemoralis*, Fab. Sandy places, Redhill.
Lytocoris domesticus, Schill. Bottoms of haystacks, Redstone
 and Colley Farms.
Piezostethus rufipennis, L. Duf. Reigate district.
Triphleps minutus, Linn. Reigate district.
Salda orthochila, Fieb. Reigate district.
 „ *saltatoria*, Linn. Roots of grass, Redhill Common; and
 on houses, Reigate.
 „ *cincta*, H.-Sch. Redhill.
Nabis apterus, Fab. Sand-pit, Redstone.
 „ *dorsalis*, L. Duf. Redstone, sweeping.
 „ *ferus*, Linn. Roots of grass, Buckland Hill; and Red-
 stone, sweeping.
Hydrometra lacustris, Linn. Ponds, Redhill.
Velia currens, Fab. Ponds, Redhill.
Microvelia pygmæa, L. Duf. Pond, Earlswood Common.
Limnobates stagnorum, Linn. Ponds, Redhill.
Naucoris Cimicoides, Linn. Ponds, Earlswood Common.
Ranatra linearis, Linn. Ponds, Earlswood Common.
Nepa cinerea, Linn. Ponds, Earlswood Common.
Notonecta glauca, Linn. Ponds, Earlswood Common.

The President brought for exhibition a very beautiful and interesting species of sponge, from the Philippine Islands, called *Euplectella speciosa*. It was hollow, nearly cylindrical, somewhat larger at the upper part, seven to eight inches long, and gracefully curved, somewhat in shape of the letter J; its mean diameter was rather more than an inch, and it was closed at the top by an operculum or lid: the sides of the cylinder and the lid were composed of stiff spongy matter, arranged so as to form a complicated but regular network, supported by stronger ridges most elegantly disposed. This beautiful natural production is of great rarity, and is seldom seen in a perfect state. The President took the opportunity of drawing the attention of the Members to the nature and character of the Sponges generally, both recent and fossil, numerous specimens of which he

had placed on the table. Some specimens of Sponges from the chalk and flints at Folkstone were particularly alluded to.

The President stated that during a recent visit to Folkstone he had noticed two swallows there, flying about the lower Sandgate Road, on the 20th of November: they were busy fly-catching, and appeared in perfect condition.

He also stated that the traces of a large and most probably an entirely new Saurian had been discovered in East Wear Bay, in the Galt: the portions which he had examined were certain large bone-like scales, which apparently were attached to the skin of the animal in question; these were six to eight inches long, irregular ovate, and much elevated in the centre.

The President then went into an explanation and illustration of the very remarkable inflations or protuberances often found on the head and thorax of various insects. He exhibited a large number of specimens from various families of insects, to show the chief characters of the remarkable structure alluded to: passing gradually from Order to Order, he showed that these anomalies of the head and thorax were found in the Coleoptera, Homoptera, Hemiptera, Orthoptera and Diptera, but were not seen to any extent in the Lepidoptera, Neuroptera or Hymenoptera. In some instances the object of these protuberances was apparent, but in most cases no good reason could as yet (seeing how very imperfectly known the Natural History of Insects is) be given for them.

January 11, 1867.—The Secretary brought for exhibition the two following species of Coleoptera, new to the Reigate district:—

Stilicus geniculatus, Er. From roots of grass on Box Hill.

Trogophlæus tenellus, Er. Banks of the Mole, near Burford Bridge.

Mr. Sydney Webb brought for exhibition the following forty-six species of Lepidoptera, captured by himself in the Reigate district, and not previously recorded as occurring there:—

TORTRICES.

Lozotania transitana, Dbl. Redstone Wood, July, 1865.

Spilonotu rosæcolana, Dbl. Bred from rose leaves, 1866.

Spilonota aceriana, Mann. Willow-bed near Redhill Station, 1866.

Holonota Brunnichiana, W. V. Redstone, 1865.

Dicrorampha sequana, Hub. Redstone, 1865.

„ *simpliciana*, Haw. Hedge-rows, Redstone, May, 1865-6.

Stigmonota composana, Fab. Reigate Hill, May, 1866; Redstone, August, 1866.

Catoptria Juliana, Curt. Redstone, 1865.

Carpocapsa splendana, Hub. Bred from acorns, 1866.

Catoptria Ulicetana, Haw. Common everywhere amongst furze.

Argyrolepis subbaumanniana, Stn. Reigate Hill and Redstone Hill.

TINEIDÆ.

Scardia arcella, Fab. Water-meadow east of Redhill Station.

Micropteryx seppella, Fab. Chart field, Redstone, June, 1866; common.

„ *Thunbergella*, Fab. Redstone, 1865.

„ *subpurpurella*, Haw. From oaks, Redstone, end of May, 1866.

Scythropia Cratagella, Linn. On palings, Redstone and Gatton, August, 1866.

Harpipteryx harpella, W. S. Generally distributed, August, 1865-6.

Depressaria bipunctosa, Curt. At sugar, Redstone, Sept. 1865.

„ *allella*, Fab. Redstone Wood, end of Aug. 1866.

Gelechia rufescens, Stn. Redstone, July, 1865.

„ *mulinella*, Tisch. Top of Redhill, beginning of Aug. 1866.

„ *luculella*, Hub. Redstone Wood, July, 1866.

„ *maculea*, Haw. Redstone Wood, end of July, 1866.

„ *tricolorella*, Haw. Redstone Wood, end of July, 1866.

Chelaria conscriptella, Stn. Water-meadow, Redhill Station, July, 1866.

Æcophora pseudospretella, Stn. Common everywhere.

Acrolepis granitella, Tr. On palings, Gatton Park, Aug. 1866.

Perittia obscurepunctella, Stn. Generally distributed, and not rare, end of May and June.

- Argyresthia pygmælla*, Hub. Redstone Wood, June, 1866.
Coleophora albicosta, Haw. Redstone, May, 1866, common.
Batrachedra præangustella, Haw. On palings near swampy ground, not uncommon.
Elachista Zonariella, Teng. Redstone Wood, August, 1866.
 „ *cerussella*, Hub. Water-meadows, &c., not uncommon.
Tischeria complanella, Hub. Common everywhere, June and September.
 „ *emuella*, Dup. Common at Redstone, June.
Cemiostoma spartifoliella, Hub. Common everywhere.
Bucculatrix Ulmella, Mann. Not uncommon, June and August.

PTEROPHORINA.

- Pterophorus Acanthodactylus*, Hub. On the chalk hills, not uncommon.
 „ *parvidactylus*, Haw. Betchworth, June, 1866.
 „ *phæodactylus*, Hub. Redhill and Reigate; common at Mickleham.
 „ *bipunctidactylus*, Haw. Redhill, July, 1866.
 „ *fuscodactylus*, Vill. Not uncommon, July.
 „ *pterodactylus*, Linn. Common everywhere, Sept.
 „ *tetradactylus*, Linn. Redhill, 1865-6.
 „ *pentadactylus*, Linn. Common everywhere, June.

ALUCITINA.

- Alucita polydactyla*, Hub. Common throughout the district.

Mr. Sydney Webb also brought for exhibition a hard and solid block of wood, of an irregular ovoid form, the knots of which were close and small, and the graining very conspicuous, but much twisted and contorted: he said that a considerable number of these substances had been removed from a cedar tree growing near Ipswich: they were found of all sizes, from one to eight inches in length, smooth and destitute of bark; always attached by a small neck of wood to the under side of the branches and might be removed from the tree by a slight tap. Some that had been opened had been found

to contain a small cavity in the centre, whilst others seemed to have a slightly harder woody core: he thought the one exhibited would be found to be solid.

The President suggested that a section should be made of the specimen, with a view of ascertaining its probable formation, and whether the lumps were originally caused by the work of an insect. He stated that small hardened lumps similar to the present were not uncommon on the trunks of some trees, although he had hitherto not observed them on the cedar.

Mr. Green read a list of seventy species of plants which he had observed in flower in the open air on Christmas-day last, showing the very mild temperature that existed up to that date; many of them were common British species, but a considerable number of them were semi-tropical plants.

The President drew the attention of the Meeting to the rainfall during the year 1866, which amounted to 36.14 inches at Reigate: this is the greatest fall he has registered during nine years, in which period the least amount fallen in any year was in 1858, when 19.66 inches fell, and the greatest, except 1866, was in 1860, when 35.76 inches fell: thus it will be seen that the fall of 1866 is about half an inch more than has been before noted, and nearly double the quantity of that in 1858.

The severe cold which has just been experienced, with the heavy fall of snow, came under discussion, when it was stated by the President that he estimated the lowest point of the thermometer, on the level of his house, about 450 feet above the level of the sea, was 12° Fahrenheit; at a lower level, the fall being about fifty feet, the temperature was 8° Fahrenheit; still lower, where there would be a difference of level of about 100 feet, the thermometer went some few degrees lower. He has reason to believe that on the level of the railway the cold was near upon zero. The effect of these various degrees of cold upon vegetation he stated he would, at a future Meeting, bring before the notice of the Members. The effect of snow as a preservative of vegetation has been most marked during the recent heavy fall, it being shown by the President that many plants, some of rather a tender description, had remained uninjured beneath

the snow, while the portions of the plants in question which were exposed to the free air were dead or very greatly injured.

The President exhibited an interesting series of wasps' nests, chiefly arboreal, from Trinidad, with the wasps, the constructors of these curious examples of insect architecture.

The President then gave a short description, illustrated by specimens which he placed on the table, of the various ways by which the seeds of plants were dispersed over the surface of the earth: he referred to the agency of man and various animals, of the air, water, and other means of their dispersion. He then showed the various appendages to seeds, by which the various agencies alluded to were assisted in this distribution, and also the peculiarity of many seed-vessels, by which the seeds were propelled into the air and distributed at considerable distances from the parent plant.

February 8, 1867.—Mr. Thomas Nickalls made the following statement respecting the rainfall at Dover in the month of December last. In the town of Dover, situate just above the sea-level, the quantity registered during that month was 2.70 inches; while at Dover Castle, at an elevation of 515 feet above the sea, only 0.44 inch was registered.

The Secretary read the following communication which he had received from Mr. Alfred Bennett, of Croydon, in reference to the Botany of the county:—

“ 107, High Street, Croydon,
December, 1866.

To Mr. J. A. Brewer.

Sir,

In compliance with your letter, in which you so kindly thanked me for the little information I could give you towards the ‘Flora of Surrey,’ I send you a few more notes, which I have collected during 1865-6. Knowing that it is desirable to have good opinion on the species collected, I shall endeavour during 1867 to obtain specimens of the critical species, and transmit them to you, so that should they be published they may be authenticated.”

ADDITIONAL LOCALITIES.

Papaver hortense, Hussendl. (Syme, Eng. Bot. Ed. III.)*

D.* Corn-fields, Smitham Bottom, 1864 and 1865.

Fumaria Boræi, Jord. (Syme, Eng. Bot. Ed. III.)

D. On a bank opposite the wall of Ashburnham House, Addiscombe, 1866.

Camelina sativa, Crantz.

G. In a field left hand side of the lane leading from Reigate Heath to Buckland, near the farm, 1865.

Coronopus Ruellii, Gært.

D. Smitham Bottom, 1865.

Arabis hirsuta, Br.

D. Selsdon Road, just beyond Croham Hurst, 1866.

Cerastium arvense, Linn.

D. Addington Hills, towards the village of Addington, 1865.

Cerastium aquaticum, Linn.

D. Plentiful on both sides of the road between the "Hare and Hounds" at Waddon and the new gas-works at Brimstone Barn, Waddon, 1866.

Hypericum Androsæmum, Linn.

G. Ditch-side, nearly opposite May's Farm-house, Horley, 1865.

Trifolium fragiferum, Linn.

G. Earlswood Common, just above New Pond, 1866.

Ornithopus perpusillus, Linn.

D. Frequent about Croydon.

Prunus Cerasus, Linn.

D. Croham Hurst, near Croydon, 1866.

Prunus avium, Linn.

D. Sanderstead; Addington Hills, 1865-6.

Rubus Idæus, Linn.

D. Addington Hills, abundant.

* The capital letters before the localities indicate the districts in which the localities are situate: for particulars of these districts see 'Flora of Surrey.'

Ribes nigrum, Linn.

A. In a wet copse at Beddington, 1865.

Petasites fragrans (Eng. Bot. Ed. III.)

A. Between Croydon and Beckenham ; I think on the Surrey side of the county boundary, in bloom January 22nd, 1865. Given to me by Mr. Corney, of this town.

Phyteuma orbiculare, Linn.

D. Plentiful on a hedge bank, left hand of the road to Sanderstead, just on the top of the first hill through the railway arch 1864-6.

Cuscuta Trifolii, Bab.

D. In a clover field near Duppa's Hill ; field by the footpath to Haling Grove, from the Brighton Road, Croydon ; plentiful in both places, 1866.

Verbascum virgatum, With.

G. In a field near Ringley Park, Reigate, 1865.

Linaria elatine, Mill.

G. On rubbish heaps, Earlswood Common, 1866.

Linaria spuria, Mill.

E. Near the Box Hill Railway Station, 1865.

Linaria purpurea, Mill.

D. This occurs on an old wall in Coombe Street, Croydon : it was formerly more abundant than it is now, then growing upon the walls on both sides of the road. I have known it in this place for the last ten years, and think it is perfectly naturalized.

Orobanche elatior, Sutt.

D. Duppa's Hill, Croydon, 1866.

E. Headley Lane, near Mickleham, on the left hand going towards Headley, 1866. In both these localities it occurs on *Carduus acanthoides*, Linn. In the 3rd edition of English Botany, *Carduus lanceolatus*, is given as one of the plants upon which it is found, with a note of doubt.

Orobanche Rapum, Thuill. (Eng. Bot. Ed. III.)

D. In a hedge by the footpath, leading from the foot of Chroham Hurst to Sanderstead, on Broom.

Ajuga Chamæpitys, Schreb.

D. In a field on the west side of Chroham Hurst ; roadside between Beddington and Baustead.

Cephalanthera grandiflora, Bab.

Left hand side of Selsdon Hill on the descent, and right hand side of the hill on the rise towards Farleigh, 1866.

Epipactis media, Fries.

Addington Hills, 1866.

Polygonatum officinale, All.

D. This, which I reported from Addington Hills, is not to be found there now : this year I went to look for specimens, and found that the only two plants which I had seen had been dug up, as there were the holes remaining where they had been.

Carex flava, Linn.

D. Addington Hills, 1865.

Carex vesicaria, Linn.

By the Wandle at Beddington and Waddon, 1866.

Blechnum boreale, Sw.

D. Addington Hills, 1865.

Additions to Geological Appendix in the 'Flora of Surrey.'

<i>Cerastium arvense</i> .	Thanet Sand.
<i>Trifolium fragiferum</i> .	Lower Green Sand.
<i>Orob. tuberosus</i> .	Chalk and Thanet Sand.
var. <i>tenuifolius</i> .	Thanet Sand and Chalk.
<i>Prunus Cerasus</i>	Thanet Sand.
„ <i>avium</i> .	Thanet Sand and Chalk.
<i>Rubus idæus</i> .	Thanet Sand.
<i>Pyrus aucuparia</i> .	Thanet Sand.
<i>Verbascum virgatum</i> .	Lower Green Sand.
<i>Petasites fragrans</i> .	London Clay.
<i>Epipactis media</i> .	Thanet Sand.
<i>Listera ovata</i> .	Thanet Sand.

Yours obediently,

A. BENNETT

A paper was read from Mr. Charles Green, on the effects of the late frost on vegetation at two different altitudes, at Hillfield, Reigate ; the upper level being about 450 feet above the level of the sea, the thermometer at 12 deg. Fahr ; the lower level about 400 feet above

the sea level, and the thermometer at 8 deg. Fahr. The following list of plants will show in some degree the effects of the late frost.

Upper Level. Thermometer at 12 deg. Fahr.

Edwardsia microphylla. Trained against a south wall, much injured.

Ceanothus ovatus, *C. pallidus* and *C. papillosus*. Large portions of the plants destroyed.

Clematis connata. Killed to the ground.

Genista candicans. Injured.

Calampelis scabra. Trained against a western wall, killed back.

Escallonia macrantha. South aspect, leaves turned brown and many small branches killed.

Magnolia grandiflora. Leaves browned.

Phillyrea angustifolia, and other species. Leaves killed and young shoots injured.

Aucuba japonica. Where exposed to the sun, leaves and the ends of shoots turned black.

Berberis Darwinii. Small shoots killed.

Mahonia Fortunei. Portions killed.

Spiræa Reevesii. Leaves killed.

Hedera Algeriensis. This species seems to have suffered more than any other of the Ivies with green leaves: several forms among variegations appear less hardy than the original, such as *Hedera hybernica marmorata*, *H. Helix aurea*, *H. Helix marginata*, and others, which are very much more injured than the original green form.

Veronica salicina, *V. speciosa*, *V. Andersoni*, and *V. variegata*. Nearly killed excepting where covered with snow.

Euonymus japonicus variegatus. More injured than the green form.

Pernetia mucronata. Points of shoots killed.

Rhododendron undulatum. Points of shoots killed; and several hybrid *Rhododendrons*, leaves browned, and many buds spoiled.

Calycotoma spinosa. Nearly killed.

Benthamia fragifera. Small branches killed.

Cotoneaster microphylla, and a dwarf species, not named, from India. Many leaves turned brown.

Ilex Tarago. Leaves turned brown.

Garrya elliptica. Large branches killed; portions under snow preserved.

Phormium tenax (New Zealand Flax.) Very much injured, although sheltered under a south wall.

Salvia Cretica. Killed.

Several species of Roses appear to have suffered, such as Fortune's White, *Rosa microphylla*, and varieties of *Rosa odorata* or Tea-scented, &c.

Lower Level. Thermometer at 8 deg. Fahr.

Quercus Ilex (Evergreen Oak.) Leaves browned, and killed where exposed to the sun.

Quercus Suber (Cork tree.) Leaves killed.

Pinus insignis. Many small branches nearly killed.

Torreya taxifolia. Leaves browned.

Picea cephalonica. Injured where exposed to the north-east.

Pinus excelsa. One plant suffered, while others have not.

Callitris quadrivalvis. Much injured.

Cupressus McNabiana. Nearly killed.

Cedrus Deodora. Many young branches nearly killed on some trees, others not the least injured. It might perhaps be worthy of notice respecting three plants of the *C. Deodora*, the same size, and about the same level, some ten yards apart, each alike exposed to the south, and sheltered from the north, the central plant was uninjured, while the one on the west was nearly killed, and the one on the east very much browned at the points of the branches,—a somewhat curious circumstance.

Viburnum Tinus (Laurustinus). Not so much injured as in some seasons.

Cerasus Laurocerasus (Common Laurel). Many small branches turned brown, others quite killed, especially in low situations.

Sequoia sempervirens. Small branches killed.

Cerasus lusitanica (Portugal Laurel). But little injured.

Heimia salicina. Nearly killed.

Lupinus arboreus. Killed.

Lotus sericeus. Killed after living three winters unprotected.

Gynierium argenteum (Pampas Grass). Nearly killed to the ground.

Arundo conspicua. Another fine species of Grass, and flowering much earlier in the summer : this appears to be much hardier than the former.

Rhamnus hybridus. Very much cut ; leaves all killed.

Buddlea globosa. Nearly killed to the ground.

Vinca major (Periwinkle). The variegated variety much more injured than the common green form, as is the case generally with variegations that are not natural.

List of Plants uninjured by frost. Upper Level.

Thermometer 12 deg. Fahr.

<i>Ceanothus verrucosus</i> .	<i>Pinus ponderosa</i> .
<i>Podocarpus nucifera</i> .	„ <i>Jeffrayana</i> .
<i>Araucaria imbricata</i>	<i>Cupressus macrocarpa</i> .
<i>Biota aurea</i>	„ <i>torulosa</i> .
„ <i>pendula</i> .	<i>Cryptomeria japonica</i> .
<i>Abies bracteata</i> .	<i>Ilex latifolia</i> .
„ <i>Nordmanniana</i>	<i>Mahonia Beali</i> .
„ <i>apolinis</i> .	<i>Cerasus ilicifolia</i>
„ <i>Douglasii</i> .	<i>Salvia Grahamii</i> , a Mexican species.
„ <i>Khutro</i> .	
„ <i>cilicica</i> .	

List of Plants uninjured by frost. Lower Level.

Thermometer 8 deg. Fahr.

<i>Pinus canariensis</i>	<i>Pinus Benthiana</i> .
„ <i>crinita</i> .	<i>Thuja gigantea</i> .
<i>Picea amabilis</i> .	„ <i>Lobbii</i> .
„ <i>grandis</i> .	<i>Abies Pindro</i> .
<i>Juniperus Bermudiana</i>	<i>Cupressus Lawsoniana</i> .
„ <i>excelsa</i>	<i>Cotoneaster affinis</i> .
„ <i>virginica glauca</i> .	„ <i>marginata</i> .
<i>Biota maldensis</i>	<i>Mesembryanthemum uncinellum</i> .
„ <i>aurea</i> .	

The following paper was read from Mr. James Drewett, on the effects of the late frost on vegetation, at Denbies, near Dorking, situate at an altitude of 600 feet above the sea level, with the weather as follows:—January 2nd, heavy fall of snow, about one foot in depth; January 3rd, thermometer 14° Fahrenheit, four feet from the ground; January 6th, thermometer 16° Fahrenheit, and fall of snow four inches.

The following Shrubs and Trees were not injured.

Portugal and common laurel.
 Aucuba, with berries thereon.
 Euonymus japonica (silver-edged).
 „ radicans variegata.
 Osmanthus Ilcifolia variegata.
 Retinospora obtusa.
 „ Pisifera.
 Cryptomeria japonica.
 „ elegans.
 Cedrus Deodora.
 Picea cephalonica.
 Evergreen oaks, sweet bays, and standard roses of all sorts.

The following were slightly injured.

Arbutus Unedo, where fully exposed.
 Viburnum Tinus.
 Magnolia grandiflora.
 Pinus insignis. Very slightly, in some places not at all.

The following were much injured.

Bambusa variegata, fully exposed.
 „ Himalayana.
 Euonymus japonicus variegata.
 Ligustrum glabrum.
 Rhabphaolepis photina ovata.
 Euria latifolia variegata.
 Gynerium argenteum (Pampas Grass).

Below a certain line lower down the hill, we find that *Cedrus Deodora*, *Pinus insignis* and other plants have suffered very materially.

The President exhibited a nest of social caterpillars from St. Catherine, in Brazil, beautifully constructed by the drawing together into a long rough, somewhat cylindrical tube, the leaves of a species of *Zeyhera*. This was effected by a quantity of fine glossy silk-like threads, which, drawn over the surface, held the leaves well in position, and might also be useful in throwing off the rain.

The President drew the attention of the members to a series of plants of *Primula sinensis*, in flower, which were placed on the table, his object being to show how by the aid of the horticulturist the plant had been made to vary from its original condition, which latter was shown by a plant in full flower, and which exactly corresponded with a figure published nearly fifty years since in Hooker's 'Exotic Flora.' The flowers in this plant were of a pale pink, the divisions of the corolla smooth on the margin, and the leaves somewhat round and broadly notched or lobed. From this original condition the flowers had now become changed in colour to pure white and deep rosy crimson, and all gradations of tint intervening. The margins of the corolla segments had been made to become deeply cut like a fringe, and perfectly double flowers, like a small rosette, had been produced. In the leaves a change had been effected from the normal shape, to one ovate-elongate, and so deeply cut and lobed as almost to resemble the simply pinnate frond of a fern.

The President then referred to a number of species of *Selaginella*, which he had brought for exhibition in the growing state, with a view of explaining the characters and properties of the family of plants called *Lycopodiaceæ*, nearly allied to Ferns, and which produced a number of very beautiful plants known to gardeners as Mosses, elegant in their foliage, and very easy of cultivation. The President briefly gave an account of the climate where the members of this family chiefly grow, and their geographical distribution, and how they should be treated to be successfully grown. He then pointed out how Lycopods differed from Ferns, Mosses, and allied families, and referred to the

genera *Lycopodium* and *Selaginella*, in which are found nearly the whole of the species. He then pointed out the chief properties and peculiarities of the species, particularly alluding to the inflammable nature of the spores of *Lycopodium clavatum* and *L. Selago*, and the cathartic properties of these and other species, especially *Lycopodium rubrum*.

March 8, 1867.—The President in opening the meeting briefly alluded to the loss the Club had sustained by the death of Mr. Thomas Martin, one of the Vice-Presidents of the Club, and who had filled that office since its establishment in 1857, highly respected by all the members: his loss would be deeply felt by all who knew him.

The following communication was read from Mr. Thomas Nickalls to the President, with a letter he had received from Mr. H. J. Poulter, of Dover, respecting the rainfall at Dover at two different elevations, viz., in the town of Dover, 30 feet above the sea level, and at Dover Castle, at an elevation of 512 feet above the sea.

“ Reigate, 14, 2, 67.

Sir,

I have received the enclosed from my Dover correspondent: the difference is very striking, the greatest being in 1st mo. and the smallest in 10th mo. If the first was a very windy month, and the last a very still one, I should be inclined to think whether that was not the principal reason of the difference between the readings of the two gauges; the top of the Castle being so much exposed to high winds, the rain would enter the gauge at a considerable angle. The writer is esteemed a very accurate observer.

Yours respectfully,

THOMAS NICKALLS.

Dover, 12, 2, 67.

To Mr. Thomas Nickalls.

Dear Friend,

Annexed I send a statement of the rainfall for every month last year. The difference between the two levels is striking, particularly in some instances. The lower gauge is placed in our garden; the

upper one on one of the turrets of the Castle ; both have been duly tested. I have been informed that in one of the balloon ascents it was found the drops of rain became smaller as the elevation increased, till at last the rain was like a mist. This would in some measure account for the difference of fall, were the rule universal that a smaller quantity was always collected at a high level than a low one, but, as thou hast remarked, it is not the fact. In the instance in which 0.44 is registered at the higher level, and 2.70 at the lower referred to by thee, a slight cause of the difference might be, the snow was collected in the lower one : I melted it and estimated it as rain, whilst in the upper one it was blown away ; this however could only apply in that one case, and that to a very trifling degree. The upper gauge is under the care of the sentry on duty, who has orders to prevent any one touching it. The gauges are five inches in diameter : the one at the higher level has now been in its position four years ; the observations with it are taken once a week, or sometimes twice if there has been much rain ; twice a week is as often as I am able to see it. I have examined it, and find there is no leakage, so that I am satisfied with the correctness of the quantity registered.

Thine truly,

H. J. POULTER.

*Rainfall as indicated by gauge in
Russell-street, Dover, 30 feet above
the sea level.*

1866	Inches.
1st month	4.88
2nd "	3.95
3rd "	3.—
4th "	2.—
5th "	1.12
6th "	2.66
7th "	2.55
8th "	4.24
9th "	6.13
10th "	0.84
11th "	2.88
12th "	2.70

Total for the year 1866 36.95

*Rainfall as indicated by gauge at
the top of Dover Castle, 512 feet
above the sea level.*

1866	Inches.
1st month	0.68
2nd "	0.98
3rd "	1.47
4th "	1.51
5th "	0.85
6th "	0.97
7th "	1 —
8th "	2.13
9th "	1.53
10th "	0.60
11th "	0.57
12th "	0.44

Total for the year 1866 12.73

Mr. John Linnell, jun., brought for exhibition the following three species of Coleoptera, taken by himself, and not previously recorded as occurring in the Reigate district.

Colymbetes exoletus, Forst. From a pond on Earlswood Common.

Chatarthria seminulum, Payk. Roots of grass, boggy parts of Reigate Heath.

Omalium Oxyacanthæ, Grav. Decayed rubbish, Redstone Wood.

Mr. Sydney Webb sent for exhibition the following nine species of Lepidoptera, captured by himself in the Reigate district, and not previously recorded as occurring there.

Tortricodes hyemana, Hub. Common during March in oak coppices, hedgerows, &c.

Lithocolletis sylbella, Haw. Not uncommon, Wray Lane and Redstone Hill, June and August, 1865.

„ *salicicolella*, Sircom. Redstone Wood, June, 1866.

„ *tristrigella*, Haw. Common on palings.

„ *trifasciella*, Haw. On palings and hedgerows, September not uncommon.

Nepticula ruficapitella, Haw. Not uncommon early in June.

„ *Oxyacanthella* Stn. One specimen, Redstone Wood, June, 1866.

„ *pygmælla*, Haw. Redstone, 1866.

„ *subbimaculella*, Haw. Common among oaks.

The Secretary read the following communication from Mr. A. Bennett, of 107, High Street, Croydon, respecting the Botany of the county of Surrey, containing additional localities for several of the local species, and also additions to the geographical distribution of Surrey plants.

107, High Street, Croydon,
20th Feb., 1867.

To Mr. J. A. Brewer,
Sir,

The very flattering manner in which you speak of my additions (though small) in your letter, has induced me to look

again through my notes, and to send you a few additions to my last. I would add that H. Trimen, Esq., has published a list of localities, &c., at pages 78 to 94 of the 2nd vol. of the 'Journal of Botany.' I merely mention this in case it should not have passed through your hands; if it has not done so I shall be happy to send you a copy.

I am, Sir,

Yours very truly,

A. BENNETT.

Additional Localities.

Eranthis hyemalis, Salisb.

D. Beddington Park. It occurs in profusion among the grass, and away from houses and gardens, but still can only be considered naturalized, 1866 and 1867.

Trifolium scabrum, Linn.

D. In the Flora about Croydon is given. I have found it plentifully on Smitham Bottom, opposite the Caterham Junction Railway Station.

Epilobium angustifolium, Linn.

D. Between Cheam and Ewell, by the Railway.

Helminthia echioides, Gært.

A. Norwood, 1865.

Petasites vulgaris, Desf.

D. Plentiful by a stream at Waddon, that runs into the Wandle.

Campanula latifolia, Linn.

D. In a hedge by a footpath opposite the Schools at Banstead, near the Church, very fine in 1865.

Antirrhinum majus, Linn.

D. Walls at Chroham, near Croydon (escaped).

Anacharis Alsinastrum, Bab.

D. In the Wandle at Waddon.

Eriophorum angustifolium, Roth.

D. In a boggy spot at the foot of Addington Hills, towards Shirley, growing with *E. vaginatum*.

Additions to Geological Appendix in the 'Flora of Surrey.'

Cardamine hirsuta	Thanet Sand.
Arabis thaliana	"
Viola odorata	"
Dianthus armeria	"
Hypericum hirsutum	"
Epilobium hirsutum	"
Saxifraga granulata	"
Galium verum	"
" palustre	"
" saxatile	Chalk.
Knautia arvensis	Thanet Sand.
Chrysanthemum Leucanthemum	"
Pyrethrum Parthenium	"
Achillea Ptarmica	"
Verbascum nigrum	"
Bartsia Odontites	"
Linaria vulgaris	"
Digitalis purpurea	"
Calamintha officinale	"
Lithospermum officinale	"
Primula vulgaris	"
Plantago Coronopus	"
Humulus lupulus	"
Betula alba	"
Orchis maculata	"
Habenaria bifolia	"
Ornithogalum umbellatum	"
Tamus communis	"
Juncus squarrosus	"
" setaceus	"
Carex stellulata	"
" flava	"

The Secretary remarked that all the additions to the Geological distribution of plants, with one exception, were additions to the

Thanet Sand formation, which is a very narrow strip, adjoining the northern portion of the Chalk formation, and extending from Leatherhead to the eastern boundary of the county, and stated that the list of plants occurring on that formation was very imperfect at the time of the publication of the Surrey Flora, and that although it was highly probable that these and many other plants occurred there, from the fact of their being found on the Lower Green Sand, and other sand formations of the county, yet without proof of it they were necessarily omitted.

The President stated that three specimens of the Stag Beetle, (*Lucanus cervus*) were dug out of the ground in the Holmesdale Road, Reigate, on the 24th of December last, proving that this species does sometimes live throughout the winter in a dormant state. He also stated that a few days since he had observed a Black Swan flying across the valley.

The President presented to the Club, on behalf of Mr. Sore, of the Railway Hotel, an interesting specimen of a species of *Polyporus*, which had been found at Spinney Abbey, Lincolnshire, attached to an ancient tree, which had been dug out of boggy soil, fourteen feet from the surface of the ground. The specimen was coloured black, but was exceedingly well preserved, and must be of great antiquity, seeing the depth of the bog from which it was obtained. In connection with this *Polyporus* the President exhibited specimens of the wood of the Oak, Scotch Fir, and Yew, which had been dug out of a deep bog in Queen's County, Ireland, some few years since. He stated that the specimens had been sent to him soon after they were taken from the bog, and he then had them squared into blocks of the same size. The Oak, which had been stained by the bog a grey-black colour, had much contracted and warped by the process of drying, while the Scotch Fir and Yew, which retained much of their original colours, had dried very equally, and the shape of the blocks remained unchanged, and the wood appeared perfectly sound and good, notwithstanding the very great age of the specimens.

The President brought for exhibition a healthy well-grown plant of *Drosera dichotoma* from the bogs of New South Wales with its leaves covered with long glandular hairs, producing glittering viscid

secretions at their apices, which act as fly-traps to small insects which get entangled among them, much in the same way as our common Sundews (*Drosera rotundifolia* and *D. longifolia*) act upon the small insects found in our wet boggy places. The leaves of the Sundews of this country are rounded, or ovate-elongate, but those of the specimen exhibited were parted dichotomously into long narrow spreading divisions, giving the leaves a very peculiar shape, and extending the fly-catching process much more widely. The President availed himself of the occasion to call the attention of the members to several other plants which by various means had the property of catching flies and other small insects. The plants which might be called fly-catching plants, he classed under four separate heads: 1st, Such as Sundews, where the fly-catching process consisted of glandular viscid hairs, as before described. 2nd, Such as some species of *Silene*, where the flower-stem gives out a viscid excretion, which holds small insects very firmly when they touch it. 3rd, Such as the curious *Dionea muscipula*, which has at the end of its leaves a remarkable appendage like an out-spread rat-trap, which closes suddenly when the surface is touched by any insect which might alight thereon, and keeps closed while the irritation of the struggling insect remains. And 4th, Such plants as *Apocynum Androsæmifolium* one of the Asclepiads, which have in the centre of the flower a very remarkable arrangement of the several organs, of a very irritable nature, which closes upon the proboscis of flies and other insects sucking sweets, and holds them prisoners until the death of the insect causes the irritation to cease.

The President placed upon the table an orchid of the genus *Maxillaria*, having a great number of pseudo-bulbs, arranged on branches of the plant, which is strictly aerial, that is to say taking its chief nourishment from the air. He explained the nature of these pseudo-bulbs, as reservoirs of nourishment for the plants at times when the aerial roots are inactive. He compared them with other root-like reservoirs of nourishment, such as the common Potato, Onion, Tulip, &c., and showed how they differed, but all tending to the same important end, in the nourishment of the plant at certain times of its existence.

April 26, 1867.—Mr. John Linnell, jun., brought for exhibition a specimen of *Halias quercana*, W. V., a species of Lepidoptera new to the Reigate district, captured by himself, at sugar, in Redstone Wood in June, 1856.

Mr. Sydney Webb brought for exhibition the three following species of Lepidoptera, captured by himself, and new to the Reigate district :—

Platypteryx hamula, W. V. Beaten from oaks, Redstone Wood.

Ennomos fuscantaria, Haw. Redhill, at light.

Nonagria crassicornis, Haw. Redhill, at light.

The President drew the attention of the meeting to the snow which fell on the 19th of March, about 9.45 A.M., at Reigate: it consisted of small irregular angular pieces of very transparent sparkling ice, either in separate masses, or two or more agglutinated into very irregular shapes; it was very dry to the touch, and hard. The angular pieces varied in size from that of a small mustard-seed, to a small pea: when several were joined together they had the appearance of a snow-flake in the air, but broke up immediately on falling against any hard resisting substance. Later in the day, about 11 A.M., snow of the usual kind fell in the city, but very remarkable for the size of the flakes, some of which when measured were one and a half inch to two inches broad and long when spread on the ground: at noon on the same day and same place, within one hour of the snow, frozen rain fell for a short time in round transparent drops.

The President mentioned that during one of the snow showers of the month a sky lark rose singing, ascending into the snow until it was lost to sight, but its song was still heard in the air.

He also stated, in reference to the early movement of the sap in trees, that this fact became very apparent in quite an unusual way. A Maple tree had had its branches shortened about the beginning of March, and on the night of the 9th of March it froze rather sharply; on the morning of the 10th of March, icicles, one of which was more than eight inches long, had formed at the ends of the cut branches,

hanging perpendicularly, and tapering to a graceful point ; they were produced by the flow of sap from the Maple, were transparent, nearly colourless, and of a very slight sugary taste. The flow of sap must have been abundant, and seeing that the opening of the buds of the Maple takes place usually about the beginning of May, this flow of sap was taking place some seven weeks before the expansion of the leaves. (See Pl. 1, f. 2.)

The President exhibited a quantity of small black insects, when in mass looking like so much fine gunpowder, which had been sent to him from Yorkshire, and obtained in the high road near Middlesborough, where they had appeared in immense profusion in the vicinity of puddles which had resulted from the thawing of the snow. The snow had been some time on the ground, and the insects, which belong to the family Poduridæ, appeared immediately after the snow had melted.

The President then addressed the meeting, and pointed out the botanical characters, peculiarities, geographical distribution, medicinal and other properties, of the large and interesting family of plants known as Arads, of which our common *Arum maculatum* is a good illustration. Some very curious examples of this family of plants were placed on the table, to which the President alluded, and particularized the more remarkable species.

Annual General Meeting, July 12th, 1867.

TENTH ANNUAL REPORT.

The Holmesdale Natural History Club has now been in existence for ten years, and the Committee in making their Annual Report have to look back with pleasure at its gradually increasing prosperity and usefulness, especially in extending a taste for Natural History pursuits in this neighbourhood.

During the past year the resignations and admissions have been about the same in number ; seven members and four subscribers have been elected.

The Club has sustained a great loss by the death of one of its Vice-Presidents, the late Mr Thomas Martin, who had ably filled

that office since its establishment, in 1857, highly respected by all its members, and his loss is deeply felt by all who had the honour of his acquaintance. The promotion of Natural History pursuits was always considered by him of very great importance; and although of late years he had been unable to pursue it actively in the field, he never lost an opportunity of urging on the young and rising generation its importance and advantages.

The following donations to the Library and Museum have been received during the year:—

A large and very handsome Case of Reptiles, Snakes and Lizards (the skins of which had been previously presented to the Club by Mr. Cubitt, M.P.), the setting up and the case presented by the President.

'Cybele Hibernica,' by D. Moore, Ph.D.; thirty-nine specimens of British plants; 'Journal of the Linnean Society,' Nos. 35 to 38 on Botany, and Nos. 31 to 34 on Zoology; presented by the President.

A large species of Lizard from Australia; presented by Mr. Price Major.

'Proceedings of the Zoological Society, from 1831 to 1861,' thirty-one vols.; and five parts (parts 1 to 5) of the 'Transactions of the Zoological Society;' a collection of Reptiles, from India, in spirits; presented by Dr. J. A. Power.

A species of Polyporus attached to a portion of an ancient tree, dug out of a boggy soil, fourteen feet below the surface of the ground, at Spinney Abbey, Lincolnshire; presented by Mr. Sore.

A nest of the Long-tailed Tit; presented by Mr. Chandler.

Increased attention has been given during the year to the Entomology of the neighbourhood, which has resulted in the addition of 28 species of Coleoptera to the Fauna of the district, one of which (*Homalota Saundersi*, Rye) is a species new to Science, and was named after the President of the Club. Fifty-nine species of Lepidoptera, not previously recorded as occurring in the district, have also been exhibited at the meetings; and 100 species of Hemiptera have been collected and recorded as Reigate species, being the commencement of a list to be prepared for publication.

Three excursions only have been made by the members of the Club during the past year ; arrangements had been made for another, and the notices sent to the members, but the weather being very unsettled, and the day turning out thoroughly wet, it was unavoidably put off. During these excursions numerous specimens of insects were collected by the members, chiefly in Lepidoptera, Coleoptera, Hemiptera, Hymenoptera and Diptera ; and many interesting plants were also collected.

The following statement of the accounts of the Club for the past year was read by the Treasurer, showing a balance in hand of £17 13s. 11d.

HOLMESDALE NATURAL HISTORY CLUB IN ACCOUNT WITH THE TREASURER.

1866-67.		1866.		1867.	
Receipts.		£	s.	d.	
Balance brought from last Year		5	14	3	
Amount of Subscriptions received for the year 1866-1867		20	5	0	
Ditto of Arrears recovered		17	15	0	
Donation from Mr. W. Saunders, for Rent to Midsummer, 1866		7	10	0	
Cash received for Cases Sold		1	10	0	
Payments.		1866.		1867.	
Paid Executrix of Mr. Sisson, balance of account		Aug.	£	s.	d.
Public Hall Company, for half-years' Rent to Midsummer, 1866, Coals, Coke, Gas, &c.,			0	19	1
Secretary, for Postage-Stamps		Sept.	8	0	6
		1867.	2	0	0
S. Brewer, for Periodicals, Stationary, &c., as per account		Jan.	1	7	2
Paid Treasurer for Cheque-book, Stamps, &c.			0	11	4
Public Hall Company, for Rent, Coals, Gas, Coke, &c., to Christmas, 1866			7	16	9
Killick's Bill for Writing on Door			0	6	6
Reeves, for Stuffing Fox			1	0	0
April Secretary, for Postage-Stamps, and Omnibus Fares, as per his Account			2	3	6
C. Joyes for Attendance to Room		June	2	10	0
Poundage to Collector		July	0	5	0
Public Hall Company, for Rent, Gas, Coke, &c., to Midsummer, 1867			8	0	6
				35	0
				4	
12. By Balance:—Cash in hands of Treasurer £13 15s. 9d.					
Cash at the Bank				17	13 11
				£52	14 3

The following gentlemen were elected Officers and Committee for the ensuing year :—

President—W. WILSON SAUNDERS, F.R.S.

Vice-Presidents—C. HOLMAN, M.D., and ELIJAH CHAMBERS.

Treasurer—PERCIVAL WRIGHT.

Secretary—JAMES ALEXANDER BREWER.

Curator—JOHN LINNELL, jun.

Other Members of the Committee,

DR. BOSSEY.

B. R. C. ROUSE.

THOMAS HART.

EDWARD SAUNDERS.

JOHN LEES.

SYDNEY WEBB.

FIELD MEETINGS.

August 18, 1866.—On this occasion the members proceeded by train to the Gomshall Railway Station, and walked thence to Abinger, through beautifully shady lanes and open fields, along the margins of running streams, and through some portions of the finely wooded districts in that neighbourhood, collecting on their way numerous specimens of plants, among which were several rare and local species, but none entirely new to that district. The Entomologists were busy as usual, and various specimens, chiefly of Lepidoptera and Coleoptera, were captured by them. They walked back to the Gomshall Station and returned by train, after having enjoyed a very delightful day.

September 22, 1866.—Notices had been issued to the members of an excursion to be made on this day to Marden Park and the Godstone Stone Quarries, but it being a very wet day no excursion took place.

May 25, 1867.—The members made an excursion to Gatton and Chipstead. The effects of the late frost were very marked in every direction, particularly on the young shoots of the common Nettle, Brake, Fern, and Ash: these in many places were completely destroyed, having a drooping appearance, and looking as if singed and blackened by fire. The young shoots of several other plants were more or less cut by the frost, particularly in exposed situations open to the north. Vegetation of low growth seems to have suffered but little from the cold when sheltered from the wind. In a wood between Gatton and Chipstead the Fly Ophrys (*Ophrys muscifera*) was found well in flower, and several other interesting plants were observed in flower or in a very forward state for bloom. The Entomologists found numerous larvæ, and some interesting Hymenoptera and Diptera were taken. A neatly contrived nest, supposed to be of a spider, in the aperture of a

small *Helix*, was observed, but the maker of the nest could not be discovered. The following species of Coleoptera were taken on this occasion, *Gonioctena 10-punctata*, Linn., beaten from willow trees on Reigate Hill; *Choleva spadicea*, Sturm.; *Ocalea picata*, Kirby; *Ocalea badia*, Er.; *Trichophya pilicoruis*, Mann.; and several species of *Homalota*, *Lithocharis*, &c., from dead leaves in the Gatton Woods. After exploring the Gatton and Chipstead Woods, the members walked on to the Merstham Station, returning thence by train.

June 29, 1867.—The Club made an excursion by train to Gomshall Station, and thence walked to Ewhurst Mill and back. The day was remarkably fine and the views clear, and the members were much pleased with the fine hilly country they had to ramble through. Soon after leaving the station the boggy piece of ground near the Railway Bridge occupied the members for some little time, hunting for the numerous bog and water plants to be found there, *Orchis palustris* was in very fine flower and somewhat abundant. The sandy ground on the rise south of the boggy ground was found wonderfully infested with corn Spurrey (*Spergula arvensis*): some fields were literally covered with the weed, to the exclusion of other vegetation. In the narrow lanes leading to the open heathy country a very extraordinary development of the leaves of the wild Strawberry (*Fragaria vesca*) was noticed: this development occurred on rather shady moist sandy banks; the leaves were quite double their usual size. In the same lane the common Brake (*Pteris aquilina*) grew very tall, with finely expanded fronds of a very delicate texture, and much more beautiful than when exposed to more light and wind. Some remarkably exposed roots occurred on a very steep sandy bank on the road-side at the top of the hill by Ewhurst Mill: these were of the common Larch, and were found so to have accustomed themselves to their altered circumstances that they assumed the nature of stems, and were covered with well-formed bark of the usual aerial character.

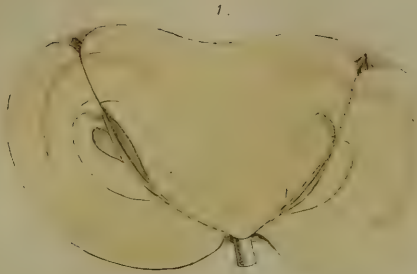
This excursion is admitted by the Lepidopterists to be the most successful one ever undertaken by the Club. The following are a few of the species captured by them on this occasion:—*Euthemonia*, *Russula*, L., *Lithosia mesomella*, L., *Epione adrenaria*, Hub.,

Angerona prunaria, L., *Macaria alternata*, W. V., *M. notata*, L.,
Panagra petraria, Hub., *Fidonia piniaria*, L., *Coremia quadri-*
fasciaria, L., *Hypera crassalis*, Fab., *Crambus falsellus*, W. V.,
Antithesia sauciana, Hub.

Delaware
 March 1880.

EXPLANATION OF PLATE.

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- Fig. 1. Section of Double Apple. See pp. 34 & 36.
,, 2. Branch of Maple, showing Sap Icicles. See p. 62.
,, 3. *Homalota Saundersi*, Rye (magnified). See p. 35.
,, 4. *Oxypoda glabriventris*, Rye (magnified). See Proceedings, December 8, 1865, p. 6.



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PROCEEDINGS
OF THE
HOLMESDALE
NATURAL HISTORY CLUB,
REIGATE.

1871-1872.

REDHILL:
PRINTED BY THOMAS WELLER, STATION ROAD.

PROCEEDINGS
OF THE
HOLMESDALE
NATURAL HISTORY CLUB,
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1871-1872.

REDHILL:
PRINTED BY THOMAS WELLER, STATION ROAD.

HOLMESDALE NATURAL HISTORY CLUB.

PROCEEDINGS,

1871-1872.

At the Annual General Meeting of the Club, held 13th October, 1871, W. W. SAUNDERS in the Chair, the business commenced at 7-30 p.m.; and the following report of the Committee was read by the Secretary.

REPORT.

In presenting the 14th Annual Report to the members and subscribers of the Holmesdale Natural History Club, the Committee have much pleasure in alluding to the Club's still increasing popularity and prosperity. Eleven new members have been added to the club during the past year, whilst but few have resigned, or been removed by death. The numbers at present on the books are 102.

During the last year the following Donations have been received :—

The proceedings of the Northumberland and Durham Field Club, in two parts; presented by the Club, through Mr. Chambers.

Six Hundred specimens of British Lepidoptera, representing one hundred and fifty six species, by the Secretary.

Entomology, as usual has occupied the attention of several of the members, and has resulted in the addition to our district Fauna of ten species of Hemiptera, and twenty four of Lepidoptera, of which six are Geometrina and the remainder Tineina.

The open evening meetings have been well attended, the subjects were

On the precious metals, Gold and Silver; by PROFESSOR TENNANT, F.G.S., &c.

The Anatomy of Insects; by B. T. LOWNE, ESQ. M.R.C.S.

An open microscopic evening was also held, and gave much pleasure and satisfaction to those present, leading to a microscopic section of the Club being established, holding meetings in connection with the Club which are arranged to take place each Monday evening succeeding a club excursion or monthly meeting. The Committee hope that when better known, members will by their presence testify their approval of this new branch of the society.

Four Excursions have taken place during the past summer. The first on the 27th May from Godstone Road, to Tilburstow, Rabbits Heath, and Bletchingley. The second on the Twenty-fourth of June, to the Tilgate forest near Crawley. The third on the twenty-second of July, when the route was from Betchworth to Boxhill. This excursion had been proposed in company with the South London, and Croydon, Microscopic and Natural History Societies, but on account of the weather only a few members met the Holmesdale Club. The fourth excursion to the woods north of Gomshall, on the second of September, was in search of Fungi; but in consequence of the dryness of the atmosphere but few were procurable.

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In consequence of the death of our late Treasurer, no cash account was submitted to the members at the last General Meeting, a Balance Sheet therefore for the two years, 1869-1870, and 1870-71 will be laid before the members.

The Report having been adopted, the Treasurer presented his Balance Sheet, which was audited and found correct.

At the unanimous desire of the members, W. W. SAUNDERS, ESQ., F.R.S., &c., consented again to fill the office of President, and the Committee as at present constituted was again elected.

R. C. BAXTER, ESQ., was elected Treasurer; S. WEBB, ESQ., Secretary.

The President nominated CONSTANTINE HOLMAN, ESQ., M.D., and ELIJAH CHAMBERS, ESQ., Vice-Presidents for the ensuing year.

It was resolved that a corrected list of Members and Subscribers be printed and issued.

At the close of the annual general meeting, the monthly evening meeting was held: Anstead's Physical Geography, and Duncan's Transformations of Insects were presented by Dr. Holman, and the Journal of the Linnean Society, Botany, and Zoology for the year 1869, were also presented by the President

The Secretary stated that a collection of plants of the neighbourhood had been sent in for competition, in accordance with the notice given in April last. A sub-committee to report on the collection at the next meeting of the club was appointed.

The Secretary brought for the purposes of record, the following six species of lepidoptera, new to the Reigate Fauna.—

Aleucis pictaria Curt, Redstone Hill.

Eupithecia subfulvata Haw., occasionally throughout the district.

„ *Haworthiata* Dbl. Wray Lane.

„ *constrictata* Gn. Reigate Hill.

Miana arcuosa Haw. at Station gas lamp.

Cirrhœdia xerampelina, at ditto, single specimen.

The President exhibited leaves of *Cornus alba*, and pointed out the very beautiful, elegant, and regular way they were mottled with bright yellow, and vivid green. Several leaves were placed upon the table obtained from different branches of the shrub, almost exactly alike in colour and markings, showing that the law of discoloration was acting very uniformly over the tree from which they were taken. He also exhibited the ripe fruit of a very rare species of the Pear family (*Pyrus cordata*), which he had recently received from Brittany, through the kindness of Mr. D. Hanbury; the fruit was small, about the size of a hazel nut, brown and somewhat pear shaped, it was produced in abundance on spurs along the branches, and had a pleasant subacid taste, it is used in the same way as the common medlar. The president said that he had received some plants of the pear in good condition, and hoped to report more fully on its merits hereafter.

Two Fungi sent to the President by A. Way, Esq., were placed upon the table; one being the elegant cup-shaped *Cyathus striatus*, which is not uncommonly to be seen on dead sticks and decaying wood; the other a small reddish brown puff ball looking fungus, about the size of a pea; probably the *Lycogala epidendrum* in a young state.

The President stated that he had quite recently had the fruit of the Poca, *Phytolacca decandra*, sent to him with a request that he would state whether the blackberry looking fruit was edible; and he therefore thought it desirable to

place a good example of the ripe fruit before the meeting and to make the following observations, "What is commonly called the fruit is a congregation of black juicy fruits, placed upon a common axis and varying from three to five inches in length, and one to one and a half in diameter. When bruised, the fruit gives out freely a brilliantly coloured juice of a deep rich claret. The plant is not uncommonly grown in some gardens on account of its beautiful and remarkable fruit, it is also naturalized in some parts of the south of Europe. According to Lindley's vegetable kingdom, the Pocan fruit has the following qualities. A tincture of the ripened berries has had a well founded reputation for the cure of chronic rheumatism. A spirit distilled from the berries was so poisonous as to kill a dog ten minutes after it was administered. The juice when externally applied causes a sense of heat and smarting. The effects of the poison of the berries appears to be violent and unequal according to circumstances. It is said that the juice was once used in the colouring of port wine, but given up on account of the bad flavour it gave the wine."

The President exhibited a very remarkable epiphytical orchis from the East Indies, *Bolbophyllum Careyanum* producing a large number of closely congregated heads of flowers, much resembling rich orange brown fir cones, and showing one of the curious forms of inflorescence, the epiphytical orchids occasionally assume. He also exhibited a beautiful ball of the most transparent Rock Crystal from Japan, nearly three inches in diameter showing the admirable workmanship of the Japanese, the ball being a most perfect sphere, and bearing a polish of the highest character: also a very fine specimen of the rare fossil *Glyptocrinus expansus* obtained from Germany, and found in the Silurian deposits of that country. The President made a series of remarks on

the nature of the fossil in question, showing how prevalent animals of that character were about the time of the Silurian epoch, and how few and small were the representatives at the present day.

Also a small but interesting collection of butterflies and moths from the Amoor river district, in N.E. Asia. These were placed side by side with species from our own country to show how great a similarity one bore to the other, although the countries were so far apart. Some of the species appear to be perfectly identical with the British ones.

Mr. Charles Green brought for exhibition some telegraph wire, telegraph earthenware sockets, and wood of telegraph posts, to show the effect of a discharge of electric fluid which took place during a thundersorm at Partridge Green, near Henfield, Sussex, last June. The wire was in places reduced to powder, and the wires then gave way; the sockets were split into several fragments; and the telegraph post adjoining riven into innumerable shreds as fine as a crow-quill. The specimens were presented to the club by Mr. Green.

16th, November, 1871. This being an open meeting, MR. J. G. BAKER, of the Royal Herbarium, Kew, attended to deliver an address on "The Weeds of Cultivation." He introduced the subject by explaining briefly the office which the different parts of a plant perform in nourishing and reproducing it; dwelling specially upon the importance of the difference between true roots (which branch irregularly and do not produce buds at their nodes;) and underground developement of stem, such as are called creeping roots in popular language, (which produce buds if broken in pieces by the spade or plough.) Plants unlike animals may be re-produced in two ways, one by means of buds, and the other by seeds, so that sometimes the life of a species is carried on for a

long time without any seeds being produced. Of those plants generally known as weeds, there are in Britain upwards of a hundred species which obtain their nutriment from the land prepared by the farmer, and which are plentiful enough in some parts of the country to be hurtful to his crops ; about three fourths of these are annuals, most of which produce a very large number of seeds. An average plant of the common poppy will yield twenty flowers with 300 seeds in each ; shepherd's purse which runs on to three generations a year, 800 flowers with twenty seeds each at one generation, or 50,000 seeds a year ; *Chenopodium album* 20,000 one seeded flowers ; Broomrape 5000 seeds, and most of the others, many thousand seeds to each generation. These annuals can only be attacked whilst the crops are in progress, and the figures quoted will give an idea of how rapidly they increase if allowed to seed. An interesting but small set of annual weeds are the parasites, especially the broomrape and clover dodder ; the former springs up from the ground and remains attached to the root of the clover ; the latter springs up from the ground and fastens upon the clover by its suckers, and increases very rapidly ; neither have leaves of their own but draw all their sap from the plant they feed upon. The biennial weeds are not numerous, and can be attacked when the corn crops are down. A small number of perennials with creeping roots, especially Scabious, Sowthistle, Coltsfoot, Fieldthistle, Bindweed, Maretail, and Couchgrass, are very troublesome, and should be rooted out thoroughly at any pains, as they spread to a great depth below the surface and increase fast. New weeds are not easily introduced ; the only two which have been diffused widely during the last generation are *Veronica Buxbaumii* and the Clover dodder. Only about ten of the weeds are directly hurtful to man or beast, from the acrid or narcotic qualities of their fruits or

herbage. The number of species becomes gradually fewer as we proceed from the south east of the islands northwards and westwards. As regards the kind of soil they invest we may class them in three groups;

1st. Weeds that mark a barren, sandy or gravelly soil.

<i>Ranunculus arvensis</i> ...	Field crowfoot.
<i>Spergula arvensis</i>	Spurrey.
<i>Scleranthus annuus</i>	Knawel.
<i>Trifolium arvense</i>	Haresfoot clover.
<i>Torilis nodosa</i>	Knotted hedge parsley.
<i>Echium vulgare</i>	Vipers bugloss.
<i>Filago germanica</i> }	... Cudweeds.
„ <i>minima</i> }	
<i>Rumex acetosella</i>	Sheepsorrel.

2nd. Weeds of clayey soil.

<i>Sinapis arvensis</i>	Charlock.
<i>Potentilla anserina</i>	Goosegrass.
<i>Tussilago farfara</i>	Coltsfoot.
<i>Carduus arvensis</i>	Field Thistle.
<i>Bartsia odontites</i>	Field eyebright.
<i>Avena fatua</i>	Wild oat.
<i>Alopecurus agrestis</i> ...	Black bent.

3rd. Weeds of rich good land.

<i>Fumaria officinalis</i>	Fumitory.
<i>Senecio vulgaris</i>	Groundsel.
<i>Veronica hederifolia</i> }	... Speedwells.
„ <i>agrestis</i> ... }	
<i>Chenopodium album</i> ...	Myles Baconweed.
<i>Euphorbia Peplus</i> ... }	Spurges..
„ <i>helioscopia</i> }	
<i>Polygonum Persicaria</i> }	Peachwort.
„ & <i>lapathifolium</i> }	
<i>Mercurialis annua</i>	French Mercury.

If weeds of group one make special headway, the land wants improving by salt and manure, if those of group two, it wants draining and pulverising, whilst those of group three, indicate good soil neglected, and nothing will eradicate them but industry.



PROCEEDINGS

OF THE

Holmesdale Natural History Club,

REIGATE,

FROM OCTOBER, 1872, TO APRIL, 1875.

LONDON :

PUBLISHED FOR THE HOLMESDALE NATURAL HISTORY CLUB, REIGATE.

BY

JOHN VAN VOORST, 1, PATERNOSTER ROW.



PROCEEDINGS

OF THE

HOLMESDALE NATURAL HISTORY CLUB.

EVENING MEETINGS.

11th October, 1872.—Mr. Gilbert exhibited a variety of the Chalk-hill Blue butterfly (*Lycæna Corydon*), wanting ocelli on the hind wings; also a specimen of *Hipparchia Semele*, varying in the same way by omission of the customary ocelli.

Mr. Sydney Webb showed a specimen of *Colias Edusa*, var. *Helice*, captured at Reigate Hill; *Lycæna Adonis*, var. *Hyacinthus*; a black *Limenitis Sybilla*, from the New Forest; also a box containing about eighty specimens of *Catoptria modestana*, to show the exceeding variation of the species.

The President drew the attention of the Meeting to what he believed to be a new species of the woodlouse family, which had been taken by the Rev. T. R. Stebbing during the excursion of the Club to Copthorne. In general appearance and size it much resembled the common *Philoscia muscorum*, but differed in the shape of the anal appendages, and in the antennæ having fifteen joints instead of eight. Drawings showing the parts alluded to, much magnified, were handed round for examination.* He also exhibited specimens of *Philoscia muscorum*, from this neighbourhood, and *Platyarthrus Hoffmanseggi* (another and very small member of the same family only found in the nests of the fuscous ant), taken in Dorsetshire.

* This woodlouse was afterwards recognized as a species of *Zia*; it is well known on the Continent, but now for the first time found in this country.

8th November, 1872.—At the Special Meeting preceding the ordinary business, the notice was read inviting the members to consider a proposed alteration of Rule 8 (which relates to the Committee), as regards changing the word “seven” therein to “nine.” This alteration having been duly put was passed unanimously; after which Mr. S. Webb, the retiring Secretary, was elected as the first additional member of the Committee, and Mr. Thomas Cooper as the second.

The following exhibitions were made at the Ordinary Meeting:—By Mr. Kensitt—a fine specimen of the interesting fungus, *Clavaria fasciata*. By Dr. Bossey—a vegetable fibrous substance from New Zealand, which grows on a kind of reed near the beach, called by the natives “Puggaria”; also a curious Erodio-hygroscope, constructed by Dr. Halifax, of Brighton, by fixing the lower end of a seed of *Erodium moschatum* in the centre of a circular card and fastening a brass index to the awn proceeding from the other end of the seed. By Mr. E. Brown—two moths, one of which (*Syntomis phægea*, Linn., supposed new to Britain) was captured near Dover by Mr. Batchelor, and the other (*Pachetra leucophaea*), taken by himself some four years ago from a lamp in the Station Road, Redhill. By Mr. S. Webb—varieties of the following British moths:—*Melanippe montanata*, *M. hastata*, *M. subtristata*, and *Boarmia roboraria*, the latter a singular melanic specimen. By the Secretary—a series of *Stylopidae*, together with various bees and wasps from which they had been obtained during the spring and summer months; they included specimens of a new *Stylops* (both sexes) from Athens, and a long series of females of the rare British genus *Halictophagus*, taken at Folkestone, in August last, with its foster-parent. By Mr. Gilbert—a fossil vertebra of the Mosasaurus found at Betchworth in chloritic sand. By the President—some wood coloured green, of a peculiarly bright colour, from the action of the roots of a little fungus, *Peziza aruginosa*; also a large and fine Agaric, from meadows, Charlwood, name not determined, which grows very thickly together and forms large rings, discolouring the grass in the way of the well-known fairy-rings; also a large collection of ferns, all having a trailing character,

belonging to the genera *Asplenium*, *Davallea*, *Polypodium*, *Phymatodes*, *Niphobolus*, and *Pleopettis*; he pointed out the graceful habit of many of these plants when allowed to grow naturally, and the remarkable difference which some of the species exhibited in their sterile and fertile fronds.

13th December, 1872.—The President read the minutes of the Microscopical Section of the Club, together with a list, presented by Dr. Bossey, of such Natural History objects as had been found in the district, and whose names had been defined.

The President exhibited two rare birds from New Zealand, which probably, like the Great Auk and Dodo, will become extinct before very long; they were the Apteryx, well known as a wingless bird, but easily hunted down, although swift of foot, and the Stringops, or Owl-parrot, a bird of nocturnal habits, forming a connecting link between the birds from which it has been named; it flies with difficulty, and is easily taken. He also called attention to a remarkable series of moths furnished with appendages to the abdomen, legs, wings and palpi. Few instances were to be met with of their occurrence among the diurnal Lepidoptera, but they seemed more common among the nocturnal species. These appendages usually consisted of bundles of elongated scales or hair-like substances, and at times were so large in proportion to the insects themselves that entomologists had been much puzzled to account for such extraordinary development; but the President observed that a careful examination of the habits and economy of the insects would doubtless show that they had essential functions to fulfil.

23rd January, 1873.—W. T. Thistleton Dyer, F.L.S., Professor of Botany to the Royal Horticultural Society, delivered a lecture on "Some different Aspects of the World's Vegetation."

14th February, 1873.—The President stated that the rainfall for the past year at Hillfield had been 38·85; the average of the fifteen preceding years was 29·33, which included the very dry season of 1858, when 19·66 only was recorded.

The President drew attention to a dried specimen of an Agaric, which he exhibited, one of the species allied to *Agaricus alkalina*. Here there were two stipes and two very nearly perfect pilei, the latter being joined by a kind of natural soldering, so as to be very firmly fixed together, and forming in reality one pileus like a figure of 8. One of the stipes had given way from the ground, and had probably been broken off by the superior strength and vigour of growth of the other. This specimen, the President remarked, seemed to explain the curious appearance, sometimes noticed in Agarics, of a perfect specimen bearing in a reversed position the pileus and part of the stipes of another, the broken stipes pointing upwards. Here it might be supposed that when first growing there had been something like the condition of the Agaric exhibited; but eventually one of the specimens gained such strength as to break the weaker off and carry it into the reversed position alluded to.

The President then stated that he had brought a series of plants (which were upon the table), to illustrate the vegetation of the Coal measures; they consisted chiefly of Ferns, Palms and Cycads. He drew attention to their method of growth, fructification and the venation of their leaves, and remarked on the peculiarities of climate they required.

The Microscopical Section having had under examination slides of Diatoms from Albury Heath, Chilworth, St. Leonard's Forest, and Brockham, Dr. Bossey presented a list of the species named therefrom, according to Smith's 'Diatomaceæ.'

13th March, 1873.—Professor Rupert Jones, F.R.S., &c., gave an exceedingly interesting lecture, profusely illustrated with diagrams, on "Coal; its Origin, Place and Extent."

25th April, 1873.—Mr. Sydney Webb exhibited the following Lepidoptera, hitherto unrecorded, all of which had been taken in the Reigate district:—

Cucullia chamomilla, W. V. Taken at gas; Redhill.

Spilonota suffusana, Koll. Occasionally beaten from hedgerows; district.

Ditula semifasciana, Haw. Scarce; marsh near Redhill Station.

Dicrorampha alpinana, Tr. Plentiful on the 29th June, 1872, on Reigate Hill, where it has at times occurred before.

„ *herbosana*, Btt. A species only described as new last August; Buckland.

He also exhibited a hermaphrodite *Fidonia atomaria*, showing the sexes in a very marked and interesting manner, whilst the antennæ were intermediate, being only ciliated; that of the left (male) side, however, was more strongly developed than the other.

The President exhibited a box of specimens showing very curious fungoid growth, from the bodies of caterpillars, chrysalides, and even from insects in the winged state. The Fungi produced belonged chiefly to the old genus *Sphæria*, now subdivided into several sections according to the views of various mycologists.

GENERAL MEETING, 14th November, 1873.—The Treasurer produced the Report and Balance-sheet, which were passed, and Officers of the Club for the ensuing year were duly elected.

At the subsequent ordinary Monthly Meeting the following exhibitions were made:—

By Mr. Sydney Webb—nine species of Lepidoptera, hitherto unrecorded for the Reigate district, viz.—

Pempelia carnella, Fab. Somewhat common on the downs north of Box Hill.

Phycis palumbella, Fab. Heathy places.

Homæosoma binavella, Hüb. One specimen taken at light at Redstone, 25th July, 1873.

„ *senecionis*, Vaughan. One specimen taken at a gas-light, Redhill Station, on the same night.

Acrobasis consociella, Hüb. Bred from oak-leaves.

Anchylopera obtusana, Haw. Taken in some numbers near Three Bridges, 17th June, 1873, and subsequently.

Dicrorampha plumbagana, Tr. Common everywhere, but hitherto overlooked.

Grapholita albersana, Hüb. Near Three Bridges.

Eupeecilia notulana, Zett. Same time and place.

Also a long series of *Depressaria depressella*, one of the smaller moths, a rare and local insect in this country, although an abundant species on the Continent, where at times it almost destroys the next year's promise of the carrot and parsnep crop by its ravages among the flower and seed-heads; here it chiefly affects plants growing in the wild state.

By Mr. Turner—a collection of birds' eggs, amongst others two very minute ones found in a small domed nest on the branch of a tree in the neighbourhood of Redhill: they were recognised as eggs of the Goldencrested Regulus, but only one-half the usual size. Also an egg found, with two others, in a nest on the ground in a damp situation: it was rather larger than a Blackbird's egg; its colour pale blue without any markings. Information was desired as to what bird it could have belonged.*

12th December, 1873.—An open meeting, to which friends were invited.

Dr. Bossey, after reading a paper on the "Fall of the Leaf," exhibited under the microscope some sections of leaf-stalks and branches, showing the various changes of structure which take place when the leaves are about to fall, the most noticeable being a longitudinal section of elder, which clearly proved the continuation of the outer layer of the bark of the branch through the base of the leaf-stalk, which ultimately causes the separation of the leaf and at the same time tends to heal up the scar on the branch.

Several London friends, as well as members of the Club, also brought microscopes, and a pleasant evening was spent; at its close a vote of thanks was awarded, on a motion of the Chairman, to those who had so kindly assisted.

9th January, 1874.—Professor Rupert Jones, F.R.S., F.G.S., &c., delivered a lecture, illustrated by specimens and diagrams, entitled

* This was afterwards identified, by Mr. Dresser, Mr. H. Saunders, and other eminent oologists, as the egg of the common Starling, but no suggestion offered as to so unusual a place of nidification.

"Flint Implements, and some Characteristics of the People that used them."

20th February, 1874.—Mr. S. Webb read a paper, intended to be supplemental to Professor Jones's lecture, upon the "Flint Implements of the District," showing that not only the flakes hitherto recorded, but also most of the recognised forms of stone implements described in Evans's great work had been found in this neighbourhood.

10th April, 1874.—Mr. S. Webb exhibited a specimen of *Vanessa Antiopa* (the Camberwell Beauty), taken last season at River, near Dover. The border was yellow, instead of the usually-noticed white of British specimens. He stated that in 1872, when so many were captured, the great bulk had white margins; whereas in 1873 seven only were taken in all, no less than six of which had the yellow border.

Mr. J. Linnell exhibited a male of *Meloë brevicollis* (the Oil-beetle), taken at Redhill sand-pit.

Sir Sidney Saunders exhibited two specimens of the primitive hexapod larvæ of *Meloë*. The life history of this beetle is a curious one and will bear repeating:—The female constructs a nest in the sand at the foot of low-growing plants, in a suitable locality, and the larvæ, after being hatched, often remain together for a month without moving; they then crawl up the stems, and by springing attach themselves to wandering bees which visit the flower, and are by such means conveyed to the bees' nest, where they first devour the eggs, and, after a change of skin, become apod, or without feet; they now feed on the honey or honey-paste stored by the bees for their own progeny, and thus progress towards their final stage of development. He also exhibited a curious Coleopterous insect, found at Corfu, —*Myodites subdipterus*, Fab., belonging to the family of the *Rhipiphoridae*; several female *Stylops*, a wasp and bee-parasite, recently found at Shiere; and a specimen of *Pediculus mellitæ* of Kirby, found on Hampstead Heath, clinging to a species of *Andrena*: it

has not yet been ascertained whether this parasite is the larval form of some other insect or a perfect wingless insect belonging to Leach's order *Anapleura*; it is occasionally found in large numbers, in the same locality, early in the spring.

9th October, 1874.—Dr. Bossey brought for exhibition some rare or doubtfully native plants: among them were—*Potentilla supina*, found in Woolwich Dockyard (probably introduced among timber); *Triticum cristatum*, a native of Asia and the East of Europe; *Camelina sativa* and *Alyssum calycinum*, introduced plants, now becoming common; *Polypogon littoralis*, very rare; and *P. monspeliensis*, rare, found at Plumstead—the former appears to be dying out; and *Salvia pratensis*, from Gatton, new to our district Flora.

ANNUAL GENERAL MEETING, 16th October, 1874.—The Report, after stating that "Numerous additions, by donation and purchase, had been made to the Club collections, consisting of eggs of British birds, fossils of the Red and Coralline crags, and Lepidopterous insects—among the latter several species new to the district Fauna"—shortly enumerated the lectures and papers read before the Society, and stated that "prizes had been offered for the best collections in Botany, Geology and Entomology," closed with "an expression of regret at the withdrawal from the neighbourhood of their President (Mr. W. Wilson Saunders), to whom the Club is under such deep obligation for his zealous and valuable services, from its foundation to the present time."

BALANCE SHEET.

RECEIPTS.				EXPENDITURE.			
1873.	Balance brought			Nov. 10,	Rent, Stationery,		
Oct.	forward -	34	0 2	1873, to	and sundry Ex-		
1874.	Cash received for			Oct. 15,	penses, as per		
Jan. to	sundry Sub-			1874.	vouchers -	22	10 2
Oct. 15.	scriptions -	29	2 9		Balance in hand	40	12 9
		<u>£63</u>	<u>2 11</u>			<u>£63</u>	<u>2 11</u>

EXCURSIONS.

Several excursions were intended to be made, but, owing to various causes, two only were carried into effect, and the latter of these under unfavourable circumstances for collecting. The first, upon the 23rd May, 1874, was made to the neighbourhood of Headley Lane and Box Hill—a district previously gone over by the members. A parasitic fungus, probably a *Peronospora*, was found on *Tanacetum vulgare*, but only on a few out of the numerous plants growing by the River Mole at Burford Bridge. The fungus had the appearance of white down: it was scattered in patches at the edge and on both sides of the leaf; the leaves and plants affected by it were perfectly green, and apparently in a state of healthy and vigorous growth, in this respect contrasting very forcibly with the potato plant when it is affected by an allied species of fungus. It was remarked with satisfaction that *Ceterach officinarum*, once abundant on the south wall of Headley Lane still existed there, although in greatly decreased numbers; and that *Arabis hirsuta*, an unattractive though by no means a common plant, maintained its footing on the north wall.

The second excursion, to the neighbourhood of Three Bridges, on the 4th July, was much interrupted by rain. Many of the forest botanical specimens were, however, secured; amongst them a few plants of *Ophrys muscifera*, and a lovely variegated specimen of *Hypericum pulchrum* was found by the Secretary.

ELECTION OF OFFICERS AND COMMITTEE.

The following gentlemen were appointed Officers of the Club for the ensuing year:—

President.—Sir Sidney Smith Saunders, C.M.G.

Vice-Presidents.—E. Chambers, Esq.; Dr. C. Holman.

Treasurer.—R. C. Baxter, Esq.

Hon. Secretary.—Mr. Thomas Cooper.

Curator.—John Linnell, jun., Esq.

Other Members of Committee.—Dr. Bossey; Messrs. J. B. Crossfield, C. Green, W. H. Heaton, John Lees, W. H. Tyndall, Sydney Webb.

16th October, 1874 (Evening Meeting, held after the Annual General Meeting).—A large collection of Fungi was exhibited, chiefly contributed by Dr. Bossey and Messrs. Crosfield and Kensitt.

13th November, 1874.—Subject for the evening, “Lepidoptera captured during the past Season.”

The following, amongst others, were placed on the table:—A long and varied series of *Boarmia cinctaria* and *Zygana Meliloti*, from the New Forest; series of *Larentia casiata* and *Cidaria populata*, from Scotland; *Acidalia emutaria*, from the New Forest and Gravesend; *Homæosoma sinuella*, *H. binævella*, *H. senecionis*, *Catoptria cæcimagulana*, and other Tortrices; *Coleophora conspicuella*, a rare Tinea, that has not been taken for some years; varieties of *Arge Galathea* (Marbled White), *Polyommatus Phlæas* (Copper), *Ennomos angularia* and *Hemerophila abruptaria*, by Mr. Sydney Webb, as well as the following species, new to the district, for record, viz.:—

Rhodophæa suavella, Zin., and *Ephestia pinguis*, Haw. Taken at light, Redstone Hill, 1874.

Eubolia lignata, Hüb. Two dead specimens found in lamp at Redhill Station.

Mr. Turner exhibited a collection, amongst which was a male variety of *Satyrus Semele*, and a specimen of *Gnophos obscurata*, from Redhill Common. This last clears up an error in our lists—*G. pullaria* (probably named from Stainton's ‘Manual’) being inserted in Brewer's ‘Fauna of Reigate.’ The true *G. pullaria* is not British.

Among Mr. Linnell's exhibitions was a *Chærocampa porcellus* (Small Elephant), in good condition and of large size.

Mr. Webb read a statement of observations he had made with reference to the occurrence of Lepidoptera, pointing out the meteorological and other influences of last year, which had been expected to have some effect upon this season's collecting, comparing them with the year's result, and giving a short account of the principal captures recorded.

11th December, 1874.—Subject, "Ornithology." The Secretary exhibited a number of birds shot by himself in South Africa, comprising many rare and some undescribed species: amongst them was a Spurwinged Goose, from Basutu Land, which did not appear to be the same as *Plectoeteris gambensis*, the only African Spurwinged Goose hitherto described: the White Ibis (*Ibis religiosa*), which is seldom found so far south as the Cape Colonies; another, doubtfully referable to the Glossy Ibis (*I. falcinellus*), and the Longtailed Whydah-bird (*Chera caffra*), a very beautiful species; the Sentry Lark (*Macronyx capensis*), with a lovely orange-coloured throat; two very small Grebes, of an undetermined species; the African Oxpecker (*Buphago capensis*); Spectacled or Cape Penguin (*Aptenodytes demersus*); a Darter or Snake-bird (*Plotus le-Vaillantii*), a rare bird, which swims under water, its long and vibrating neck only extended above the surface; Parrots, Pigeons, Humming-birds, &c.

Mr. Walter Webb exhibited a collection of Australian birds, amongst which were the Black Swan (*Cygnus atratus*), from Western Australia; Giant Kingfisher (*Dacelo gigantea*), there commonly known as the "Laughing Jackass" or "Bushman's Clock"; a fine species of Nightjar, called "More-pork"; a large blue Crane, called the "Native Companion"; and a beautiful Duck, known as the "Mountain Duck," generally found in company with the last; also specimens of the Wandering Albatross (*Diomedea exulans*), fifteen feet in expanse of wing, and two smaller species.

There were exhibited, of native birds, a white Sparrow, pied Black-bird, white Sky Lark, white Bunting, a Bohemian Waxwing, and White's Thrush.

Messrs. Turner and H. Crosfield showed collections of birds' eggs.

8th January, 1875.—The Club held an open Microscopical Meeting, which was well attended. A large number of microscopes were brought by members and friends, and many highly interesting objects were exhibited.

12th February, 1875.—Subject, "Geology." Numerous oolitic and cretaceous fossils were exhibited; also mammalian remains from the crag, and Erioth tertiaries, as well as rare and curious minerals—different forms of silver, tin, iron, arsenic, antimony and galena; and in answer to inquiries, Mr. S. Webb explained the different clays of the neighbourhood, and gave a short account of the different theories as to the deposit of flint.

12th March, 1875.—The President exhibited a number of specimens belonging to the class Arachnida, which comprises the Spiders, Scorpions, Ticks, Mites and other allied tribes, and afterwards adverted to some of the habits of the Spiders proper, whose classification is principally founded upon the number and position of their eyes. He also called attention to the construction of the nests of the Trap-door Spiders (*Cteniza* and *Nemesia*), some of which, as described by the late Mr. Moggridge, have branched tubes furnished with a lower lateral door at the point of intersection, calculated to delude an enemy in pursuit along the empty branch. He stated that he had met with some having a similar trap-door at the bottom of the tube as well as one at the top, which condition could be artificially produced by reversing one of the nests in a flower-pot and breaking off the lower end, now uppermost, when the spider would construct a new trap-door to close the orifice. The President has described this species under the name of *Myggale* (*Cteniza*) *Ionica*. The nocturnal habits of *C. ariana*, one of these spiders, have been observed in the island of Tenos: they come out of their nests, fasten their open trap-door to some adjacent object, and spin a web about six inches long and scarcely half an inch in height, for the purpose of intercepting their prey, which webs are removed before morning, when the trap-doors are closed. This species, as well as *Ionica*, are now comprised in a new genus, which Professor Ausserer, of Vienna, has denominated *Cyrtocarena*.

The tent-nest of another spider, the *Clotho Durandii* of Latreille (or *Uroctea quinquemaculata* of Dufour) was shown, presenting several angular projections whereby it is attached to a rock or block of stone,

leaving the intermediate margin of the tent free in one part only, from which the constructor issues by raising the side: this tent is silk, lined below, and is of a substantial texture, capable of resisting both wind and rain.

Mr. J. Linnell also exhibited a collection of British spiders, among them *Chelifer cancroides* and *Leptus autumnalis* (the Harvest Bug); and the Secretary exhibited some African species and a nest of *Cteniza Barrowii*, Walk., an African trap-door spider.

9th April, 1875.—Subject, "Botany." The Secretary placed on the table a collection of plants, with a view of illustrating some observations on botanical classification. He contended that the conclusions too often arrived at by nomenclators with respect to species and varieties were arbitrary and without foundation, observing that the original forms of vegetable life are unknown, and that it is impossible to determine which are species and which varieties. In support he exhibited a series of *Haworthias*, recognised as species by botanists, that graduated into each other so insensibly that some who were present thought them alike: this graduation existed in the markings, form and habit—which last varied from a horizontal arrangement of the leaves to a perfectly erect one. He then compared the above series with another raised by himself from one seed-pod of *H. papillosa*; nearly all the latter differed from each other, some remarkably so, from the parent species: forms known as *H. subulata*, *H. rugosa* and *H. margaritifera* were present; one resembled, in some respects, three named species, viz. *H. Reinwardii*, *H. fasciata* and *H. clariperla*, whilst another was unlike any known species, and would, if found wild, have doubtless received a specific name. He stated that the species above mentioned, to which these seedlings approximated, were among the most distinct in the group *Haworthia*, and exhibited series of other plants to show that he did not confine his observations to any special class.

Mr. Green also showed a choice collection of rare and curious plants from different parts of the world.

TABLE OF DIATOMACEÆ,

Previously referred to (p. 4), but completed up to October, 1875.

	Reigate Heath.	Nutfield Marsh.	Gatton Lake.	Albury Heath and Chilworth.	Godstone.	Tillingbourne.	Ewhurst.	Mersham.
<i>Epithemia Hyndmannii</i> , Sm. . .								
„ <i>turgida</i> , Sm. . .			—		—			—
„ <i>granulata</i> , Kutz. . .			—					—
„ <i>argus</i> , Sm. . .			—					—
„ <i>sorex</i> , Kutz. . .			—					—
„ <i>gibba</i> , Kutz. . .			—					—
„ <i>ventricosa</i> , Kutz. . .			—					—
<i>Eunotia diodon</i> , Ehr. . .						—		
„ <i>tetraodon</i> , Ehr. . .						—		
<i>Cymbella Ehrenbergii</i> , Kutz. . .		—	—	—	—		—	—
„ <i>cuspidata</i> , Kutz. . .				—				
<i>Amphora ovalis</i> , Kutz. . .	—	—	—	—	—	—		—
<i>Cocconeis pediculus</i> , Ehr. . .								—
„ <i>placentula</i> , Ehr. . .			—		—			—
<i>Cyclotella</i> , sp. . .					—			—
<i>Campylodiscus spiralis</i> . .				—		—		
<i>Surirella biseriata</i> , D.B. . .	—	—	—	—	—	—		—
„ <i>linearis</i> , Sm. . .	—	—		—				
„ <i>splendida</i> , Kutz. . .		—		—	—	—		
„ <i>minuta</i> . .	—		—		—			
„ <i>ovata</i> , Kutz. . .	—	—						
<i>Triblionella marginate</i> . .		—						—
<i>Cymatopleura solea</i> , Sm. . .	—	—	—	—	—			
„ <i>apiculata</i> , Sm. . .	—	—		—	—			
„ <i>elliptica</i> , Sm. . .	—	—		—				—
<i>Nitzschia sigmoidea</i> , Sm. . .	—		—	—	—			—
„ <i>amphioxys</i> , Sm. . .	—		—			—		—
<i>Amphipleura pellucida</i> , Kutz. . .		—						
<i>Navicula crassinervia</i> , Ehr. . .						—		
„ <i>cuspidata</i> , Kutz. . .	—	—	—					—
„ <i>rhynchocephala</i> , Ktz. . .		—			—	—		
„ <i>firma</i> . .		—		—	—			
„ <i>ovalis</i> . .	—			—	—			—
„ <i>inflata</i> . .	—							—
„ <i>affinis</i> . .				—				
„ <i>gibberula</i> , Kutz. . .		—		—	—	—		—
„ <i>amphirhynchus</i> , Ehr. . .	—	—	—	—	—		—	—
„ <i>ambigua</i> , Ehr. . .	—	—	—	—	—	—		—
„ <i>amphisbæna</i> , Bor. . .	—	—		—				

	Reigate Heath.	Nutfield Marsh.	Gayton Lake.	Albury Heath and Chilworth.	Godstone.	Tillingbourne.	Ewhurst.	Merstham.
<i>Navicula sphærophora</i> , Kutz.	—	—	—	—	—	—	—	—
„ <i>tumida</i>	—	—	—	—	—	—	—	—
„ <i>dicephala</i>	—	—	—	—	—	—	—	—
„ <i>gibba</i> , Ehr.	—	—	—	—	—	—	—	—
<i>Pinnularia nobilis</i> , Ehr.	—	—	—	—	—	—	—	—
„ <i>major</i> , Sm.	—	—	—	—	—	—	—	—
„ <i>viridis</i> , Sm.	—	—	—	—	—	—	—	—
„ <i>oblonga</i> , Sm.	—	—	—	—	—	—	—	—
„ <i>lata</i> , Sm.	—	—	—	—	—	—	—	—
„ <i>nodosa</i> , Kutz.	—	—	—	—	—	—	—	—
„ <i>acuta</i> , Sm.	—	—	—	—	—	—	—	—
„ <i>radiosa</i> , Sm.	—	—	—	—	—	—	—	—
„ <i>divergens</i> , Sm.	—	—	—	—	—	—	—	—
„ <i>stauroneiformis</i>	—	—	—	—	—	—	—	—
„ <i>gibba</i> , Ehr.	—	—	—	—	—	—	—	—
„ <i>acrosphæria</i> , Sm.	—	—	—	—	—	—	—	—
„ <i>mesolepta</i> , Ehr.	—	—	—	—	—	—	—	—
„ <i>interrupta</i> , Sm.	—	—	—	—	—	—	—	—
<i>Stauroneis phæniceron</i> , Ehr.	—	—	—	—	—	—	—	—
„ <i>gracilis</i> , Ehr.	—	—	—	—	—	—	—	—
„ <i>acuta</i> , Sm.	—	—	—	—	—	—	—	—
„ <i>anceps</i> , Ehr.	—	—	—	—	—	—	—	—
„ <i>linearis</i> , Ehr.	—	—	—	—	—	—	—	—
<i>Pleurosigma attenuatum</i> , Sm.	—	—	—	—	—	—	—	—
<i>Synedra radians</i>	—	—	—	—	—	—	—	—
„ <i>ulna</i>	—	—	—	—	—	—	—	—
<i>Cocconeura lanceolatum</i> , Ehr.	—	—	—	—	—	—	—	—
„ <i>cymbiforme</i> , Ehr.	—	—	—	—	—	—	—	—
„ <i>cistula</i> , Ehr.	—	—	—	—	—	—	—	—
<i>Gomphonema constrictum</i> , Ehr.	—	—	—	—	—	—	—	—
„ <i>acuminatum</i> , Ehr.	—	—	—	—	—	—	—	—
„ <i>cristatum</i> , Ralp.	—	—	—	—	—	—	—	—
„ <i>curvatum</i> , Kutz.	—	—	—	—	—	—	—	—
<i>Meridion circulare</i> , Ag.	—	—	—	—	—	—	—	—
„ <i>constrictum</i> , Ralp.	—	—	—	—	—	—	—	—
<i>Himantidium undulatum</i>	—	—	—	—	—	—	—	—
„ <i>gracile</i>	—	—	—	—	—	—	—	—
„ <i>majus</i>	—	—	—	—	—	—	—	—
<i>Odontidium Harrisonii</i>	—	—	—	—	—	—	—	—
<i>Diatoma vulgare</i>	—	—	—	—	—	—	—	—
<i>Tabellaria floccuosa</i>	—	—	—	—	—	—	—	—
„ <i>fenestrata</i>	—	—	—	—	—	—	—	—
<i>Encyonema prostaticum</i>	—	—	—	—	—	—	—	—





PROCEEDINGS

OF THE

Holmesdale Natural History Club,

REIGATE.

OCTOBER, 1875 to DECEMBER, 1878.

REIGATE:

W. ALLINGHAM, PRINTER AND STATIONER, MARKET PLACE.





PROCEEDINGS

OF THE

Holmesdale Natural History Club.

ADJOURNED ANNUAL GENERAL MEETING, *Nov. 12th, 1875.*
 The Annual Report for the past year was presented and read. It enumerated the various subjects that had engaged attention at the evening meetings of the Club, and stated that three excursions had taken place during the summer, viz. on May 22, to Mickleham; Aug. 7, to Shalford; and Sept. 4, to Box Hill. Two members were reported to have been elected, and six to have resigned during the year. The donations to the Club were Mr. Cox's "Handbook of Coleoptera," and the "Index Universalis" of Agassiz, presented by Dr. Holman; and some specimens of Lepidoptera by Mr. Sydney Webb. The Balance-sheet was also read, of which the following is an abstract.

	£	s.	d.		£	s.	d.
1874. Balance on hand, as				Rent and Expenses of			
per last account ..	40	12	9	Museum	31	8	10
1875. Subscriptions				Printing, Postage, Com-			
received	27	12	6	mission, &c.....	6	1	8
				Zoologist		12	0
				Balance now on hand	30	2	9
	£68	5	3		£68	5	3

The following gentlemen were then elected as officers for the ensuing year: as President, Sir Sidney S. Saunders; Treasurer, Mr. R. C. Baxter; Secretary, Mr. J. B. Crosfield; Curator, Mr. J. Linnell, jr.; Committee, Dr. Bossey, Mr. E. Chambers, Mr. T. Cooper, Mr. C. Green, Dr. Holman, Mr. A. Keene, Mr. C. Marshall, Mr. W. H. Tyndall, and Mr. S. Webb.

The meeting was then resolved into an ordinary Evening Meeting.

The President exhibited a specimen of a new genus and species of Trap-door Spider from South Africa, also its nest constructed contrary to usual custom in solid oak-bark. He gave the following information respecting it: This spider has been recently described by the Rev. O. P. Cambridge under the name of *Moggridgea Dyeri*. Its nests were first discovered by Dr. Dyer, at Uitenhage near Port Elizabeth. They have an oval lid formed of the bark itself, and very difficult to detect from its close resemblance and adherence to the surface, especially when held down by the occupant from within. Some of these nests are stated to consist of a silken tube, scarcely more than an inch in length, formed in the folds and interstices of the rough bark, and having as it would seem, the hinged lid at the lower extremity, the tube being carried upwards from its orifice, and its exposed parts exactly resembling the surface of the bark. One of those submitted to Mr. Cambridge was constructed in the channelled groove of a piece of wood which had apparently formed part of some building. The spider differs from others notably in the absence of the usual short strong spines at the anterior extremity on the upper side of the falces, as well as in the wide separation of the eyes of each of the two lateral pairs. This spider is supposed to form its nest in channels already made and not requiring the aid of such spines in the process of burrowing; for, as the describer observes, not being furnished with the necessary implements, but gifted with the trapdoor-nest-making instinct, it fixes upon a position where excavation would be needless. Such, however, did not appear to be the case in the present instance, the nest being imbedded within the bark itself, and not prolonged to a greater extent than the tubes above referred to, viz. scarcely more than an inch, a similar nest having also been exhibited to the Entomological Society; whereas if the spider had simply availed herself of the abode of some wood-boring insect for her domicile, the gallery would probably have penetrated to a much greater distance. The spines on the falces may however be less adapted for perforating the bark than for burrowing in the earth, and the fangs be more suitable for operating on the ligneous tissues; although, as in other instances of briar-excavators, an economy of labour is effected by utilizing any channel found available for the purpose.

Mr. T. Cooper exhibited a Polyporus found growing on the root of a currant-tree, the pileus of the fungus being covered with a beautiful green growth, believed to be *Nostoc communis*, one of the Algæ. This growth had also extended to portions of the soil attached to the currant root.

EVENING MEETING, *Dec. 10th, 1875.* The President exhibited a series of Hymenopterous insects consisting of Sand Wasps (Fossores) and of Social and Solitary Vespidæ (Diptera), all European, and gave some account of their habits and economy. He also exhibited the nests of *Polistes Gallicus*, *Eumenes unguicula*, *Pelopæus spirifex*, and the briar cells of *Raphiglossa Eumenoides* and *Psiliglossa Odyneroides*; the first mentioned belonging to the Social, and the others to the Solitary Vespidæ. The nest of *Polistes* consisted of a kind of paper, usually formed by the constructor of vegetable fibres, but in one instance which he mentioned, play bills of different colors which had been placarded were made available for the purpose, as shown by the macerated layers of the respective colors, of which the cells were composed. He also mentioned the remarkable circumstance of one of these nests having been removed with a single occupant to a remote and secluded locality outside a window of his own room at Corfu, but within the exterior blinds in a treble row with many others, from whence the solitary *Polistes*, left there in possession, went back to communicate with her former companions, and show them the way to their nest; returning with two others to feed the larvæ. He explained that these coadjutors must necessarily have belonged to the original brood, as all others would have had their own larvæ to attend to, and are never tolerated in strange domiciles by the rightful owners. He mentioned this circumstance as serving to show that means of communicating their ideas to one another are available to these social communities, although confuted in other instances by some of Sir John Lubbock's interesting experiments on Ants, Wasps, and Bees. He argued that the purport of such communication would be made known to the disconsolate searchers for their lost abode, by the hilarity and energetic action of the new comer, which must have well reconnoitred the concealed locality in the first instance, and then by a series of intelligent demonstrations induced some of her former companions to accompany her back to such an unusual and improbable site, as effectually as if voice and language had been employed for this purpose. He then gave an account of the domesticated habits of the *Pelopæus spirifex*, which constructs its mud nests in houses and in occupied rooms, notwithstanding the frequent obstacle to all access thereto by closed windows. The nest which he exhibited had been constructed in his own room, and he mentioned various experiments

made on this occasion, in disturbing the spiders stored as food for the larvæ in the cells, and the removal of the egg, describing the proceedings of the constructor in connection therewith. He also explained the mode of constructing the briar-cells of the *Raphiglossa*, *Psiliglossa*, and others of similar habits; and the remarkable circumstance of the occupant of the first-made and consequently lowest cell being the last to emerge in the imago state; the lowest cells being larger and provided with a more abundant store of food, producing invariably the female sex; and the upper cells, less amply provisioned, being devoted to the males, which emerge the first in the perfect state. He also called attention to the peculiar mode in which the *Raphiglossa* reposes at night, by holding on to the extremity of a briar-snap or other projecting part with its powerful mandibles, the body being retained in a horizontal position, and having usually the wings twisted beneath the abdomen as a means of support; showing a specimen thus attached which had been killed in this position. He likewise pointed out many remarkable structural peculiarities in several of the specimens exhibited, and described the characteristic venation of the wings in the respective sections and genera, whereby the different races are readily distinguishable according to the alary system of classification.

Dr. Bossey exhibited and presented to the Club a portion of cedar wood permeated throughout by the mycelium of a fungus, stating that a large cedar tree at Chelsea had died in consequence of being attacked by this fungus. The late Mr. Quekett, from whom he received the specimen had ascertained that it was the material of which some wasps had constructed their nests.

Mr. J. Linnell, jr. exhibited several Hymenoptera collected in the Reigate district, among which were several interesting species of Tenthredinidæ comprising fine specimens of the *Sirex gigas*, *Clavellaria amerinæ*, and *Abia nigricornis* with some of their pupa cases.

EVENING MEETING, Jan. 14th, 1876. Mr. Sydney Webb presented statistics, and made some remarks respecting the rainfall of the district, giving reasons why the fall at the elevation of 274 feet above the sea level at Redhill so closely corresponds with that at Hillfield, Reigate, at an elevation of 416 feet. In the latter case the amount of the rainfall is influenced by the neighbouring hills crowned with wood, and in the former case not so much by woods as by the valley between Redhill and Redstone Hill which frequently produces currents or eddies in the air. The fall at Redhill for the years 1871 to 1874 inclusive (omitting, however, 1872—a very exceptionally wet year, and therefore not fairly to be included in such a

short series of observations) gave an average of 30·21 inches; whilst that at Hillfield for 14 years gave an average of 30·16 inches per annum. During the past year rain or snow fell on 216 days as against 229 in 1874, 227 in 1873, and 222 in 1872. The heaviest rainfall recorded at Redhill was on July 15, when it amounted to 1·36 inch. The following are the monthly totals:—

January	..	5·240	July..	..	4·890
February	..	1·225	August	..	1·925
March	..	·875	September		2·265
April	..	1·315	October	..	5·015
May	..	1·165	November		3·905
June	..	3·980	December		1·900

Total .. 33·700 inches.

The President exhibited a selection of Solitary and Social Bees, explaining the habits and economy of several species, in continuation of his remarks on those of the Solitary Wasps at the previous meeting. Commencing with the Andrenidæ or Short-tongued Bees, he mentioned the recent discovery in France of a new species of *Sitaris*, a coleopterous parasite on *Colletes succincta*, differing essentially in its habits from the British species (*Sitaris humeralis*) found in the cells of *Anthophora*. The *Colletes* egg being attached to the interior wall of the cell, the *Sitaris* larvæ are thus exposed to a number of competitors of their own race, involving many vicissitudes; whereas in the cells of *Anthophora* the bee deposits her egg on the honey-store itself, the parasitic *Sitaris* larva being therefore compelled to obtain access thereto at the moment of oviposition. In either case, after feeding on the egg of the bee in the first instance, the *Sitaris* larva changes its form from the active hexapod condition to that of a fleshy grub furnished with spoon-shaped mandibles, those of the previous stage being very acute, and it now feeds upon the honey provided by the bee for its own larva in the closed cell. He pointed out several other Short-tongued Bees liable to be attacked by different *Stylopidæ*, and called attention to the peculiarity of the legs in *Dasypoda*, *Nomia*, and some of the *Halicti*. Passing thence to the true *Apidæ*, or Long-tongued Bees, he explained the sectional groups into which these are divisible, viz. 1st, The *Andrenoides*, forming a connecting link between the *Andrenidæ* and the *Apidæ*, of which section the only British representative is *Panurgus*; 2nd, The *Dasygastres*, comprising many British species; the females are furnished with a dense brush under the abdomen, whereby they collect pollen for their young; 3rd, The *Denudatæ*, or parasitic races having no polliniferous organs, and subsisting in their larval state on the

store laid up by other Solitary Bees; 4th, The Scopulipedes, whose posterior legs are in the females densely hirsute, and are employed for the conveyance of pollen; and 5th, The Social races (Sociales) consisting of the Humble and Hive Bees; the former comprising also a closely allied group, resembling certain other species, but having the posterior tibiæ divested of pollen-plates and pollen-brushes in the female, and unable therefore to lay up any store for their young; this parasitic group lives in company with others, and is distinguished from the true Bombi by the name of Apathus. Several structural peculiarities in other tribes were also pointed out, more especially the remarkable anterior tarsi of *Megachile maritima*, a British species, and the appendages to the middle pair of legs in the males of *Anthophora*. He also exhibited specimens of the briar-cells of *Osmia tridentata*, and explained the habits of the numerous parasites which attack this bee in its several stages, comprising 13 recorded species; of these, four feed upon the egg and pollen-paste, five attack the soft larvæ externally, two attack the solid adult larvæ internally, hibernating in their desiccated tegument, one attacks the soft pupa externally, and finally a species of fly named *Conops* deposits its egg in the body of the imago itself. Specimens were also exhibited of various nests of *Xylocopa* or Carpenter Bees in cane, briar, &c.

Mr. J. Linnell, jr. also exhibited a series of specimens collected in the Reigate district, amongst which were some clearly illustrating the distinctions alluded to by the President between the pollen-bearing Bombi and the parasitic Apathi, females of the former being furnished with a ridge of stiff hairs on the hind legs, and the latter being devoid of this.

EVENING MEETING, *Feb. 11th*, 1876. Mr. Sydney Webb read a paper on the "Tent-making and Case-bearing Caterpillars." He said it was impossible, owing to their being spread over several groups, families, and genera, to class them strictly according to this peculiarity of their early life, but they might be conveniently divided into four groups; Firstly, those which without spinning an entire silken covering, contrive to disguise themselves beneath a garb of herbage which moves with them; Secondly, the silken web spinners, whose constructed habitations are ornamented or hidden from view by superadded materials; Thirdly, the constructors of simple cases made entirely from the food-plant; and Fourthly, those whose cases of silken character are unusually complicated, or elaborated from the plants themselves. He then gave accounts of the life-histories of *Geometra smaragdaria*, *Aventia*, and *Cleora*, also of the *Psychidæ* and their allies, referring to the peculiar retrogression

of the perfect female insect. He explained the cases or tents made by *Talæporia* and *Solenobia*, and related the ground of Mr. Boyd's difference with Mr. Harding's surmises as to the perennial appearance of the females in a winged state, and the position at present occupied by those enquiring into the matter; and suggested that the problem might possibly be solved by a similar power to that belonging to the hive-bee, of the queen producing sexes at will. He went through many of the *Tineinæ* or Clothes-moth group, pointing out their differences as well as consistencies of habit. He also described the oval case-makers among the Long-horns, and case-making *Gelechidæ* and *Antispila*, closing with a detailed account of the family *Coleophora*. He exhibited specimens of the various cases and many of the perfect insects in illustration of his subject, and also showed two cases made of the florets of the sea-pink, *Statice limonium*, which he believed would prove to be a perfectly new and distinct species.

EVENING MEETING, *March 10th*, 1876. An exhibition of microscopes and microscopical objects took place, to which members introduced their friends. Fourteen microscopes were exhibited by members and visitors, the objects shown including a considerable variety.

EVENING MEETING, *April 7th*, 1876. Mr. J. B. Crosfield read some notes on some of the less known birds occurring in the district, alluding in them to the Dartford Warbler and the Black Grouse as occurring at Leith Hill; also mentioning having observed the Pochard and Tufted Duck on the large lake in Gatton Park, the former in March 1875, and the latter in March 1876. He alluded also to the frequency of the Cirl Bunting in the neighbourhood, mentioning some points of difference between its nest and eggs and those of the Yellowhammer. He referred to the abundance of the Hawfinch as compared with some years ago, and spoke also of the Crossbill, Brambling, three sorts of Woodpecker and other species.

Dr. Bossey exhibited under the microscope the spores of *Equisetum arvense*, each of which was seen to have four filaments, club-shaped at the end, attached to it. These are so susceptible to moisture that they immediately become curled up spirally if merely the moistened hand is placed near them, and when the source of moisture is removed they expand again instantly.

He also showed a drawing of a crystal produced on a surface of water when slowly frozen in a condition of absolute stillness, when the true crystalline form is exhibited.

Mr. Sydney Webb exhibited specimens of the Peacock butterfly (*Vanessa Io*) showing various malformations. In one case ichneumons had emerged from the body of the insect after it had attained the perfect state, but before the wings were hardened. He also referred to an instance in which the fore and hind wings on one side in an individual of this species were united together at the base in such a manner that one could not be expanded without the other.

He also exhibited specimens of *Stachydalis*, an insect lately found to be new to Britain, and easily mistaken for the common *Sticticalis*.

Sir Sidney S. Saunders exhibited two specimens of *Stylops spencei*, (the species parasitical upon *Andrena atricornis*) taken by himself. This has hitherto been considered a very rare species, but he stated that numerous captures had been made about the same time at Hampstead, by other collectors.

ANNUAL GENERAL MEETING, *Oct. 13th*, 1876. The Annual Report was read and adopted. The first portion of it recounted the proceedings at the Evening Meetings, including the papers read, and the most interesting of the objects exhibited. It then referred to the outdoor meetings of the Club. During the summer, five excursions were made as follows: On April 29th, to Chilworth and Gomshall; May 27th, to Reigate Heath; June 24th, to Godstone, walking thence to Merstham; August 5th, to Betchworth, returning by the hills to Reigate; and September 2nd, to Gatton Park. Those to Reigate Heath, Betchworth, and Gatton Park were afternoon excursions only. Rather special attention at these outdoor meetings was paid to Botany, to which comparatively little time was given during the winter, and especially to the useful work of verifying or recording the stations for any plants of rarity or interest. *Veronica montana*, *Moenchia erecta*, *Saxifraga granulata*, and *Teesdalia nudicaulis* were met with at Chilworth, and *Daphne Laureola* near Gomshall. *Teesdalia nudicaulis* was also found on Reigate Heath; *Sambucus Ebulus* (Dwarf Elder) and *Vinca minor* were found to be still growing near the upper pond in Gatton Park; and the Horse Radish (*Cochlearia Armoracia*) was also found (not in flower) in the same neighbourhood, in a position where it was judged to be wild. At Godstone, the extensive caves were visited from which white sand is excavated in great quantities, so largely employed in glass-making. On leaving the Lower Greensand at Godstone, and coming across the valley northwards to the Upper Greensand and Chalk Marl, another way was noticed in which the products of the earth in this neighbourhood contribute to the manufacture of glass. A quarry

was observed where a number of slabs of "Firestone" about 4 ft. long by 2 ft. wide, were lying to harden in the air. These are used for rolling large sheets of glass upon, being superior to any other kind of stone for the purpose, owing to the way in which they resist great heat without cracking or splitting. Among the insects taken during the excursions may be mentioned *Coleophora genistæ*, found at Reigate Heath in abundance. This is an old locality for the insect, but it has not been met with there for some years.

The following is the statement of accounts:—

	£	s.	d.		£	s.	d.
Oct. 9th, 1875. To Balance				By Rent of Room	22	10	0
on hand	30	2	9	„ Gas, Firing, & Atten-			
1876. To Subscriptions				dance	2	3	7
received	20	16	0	„ Printing copies of			
				Proceedings	5	11	0
				„ Collector's Commission,			
				Printing, Postage,			
				Periodicals, &c... ..	4	9	2
				„ Balance on hand	16	5	0
	£50	18	9		£50	18	9

A letter was read from Sir Sidney S. Saunders resigning his office as President of the Club, on account of his removal from Reigate. On the motion of Dr. Bossey a vote was unanimously adopted expressing the regret of the Club at the President's resignation, and its thanks for his many valuable services.

The following gentlemen were elected to serve as officers of the Club for the coming year: as President, Dr. Bossey; Treasurer, Mr. R. C. Baxter; Secretary, Mr. J. B. Crosfield; Curator, Mr. J. Linnell, jr.; Committee, Dr. Holman, Messrs E. Chambers, T. Cooper, H. E. Cox, C. Green, A. Keene, C. Marshall, W. H. Tyndall, and S. Webb. The President nominated Mr. Tyndall and Mr. Webb as Vice-Presidents.

The Meeting was then resolved into an ordinary Evening Meeting.

The President produced some oak-twigs, and called attention to the readiness with which they may be broken at certain points. He had been led to examine the cause of this with the aid of the microscope, in connection with his investigations on the subject of the Fall of the Leaf. The latter appears to be occasioned by a layer of cellular tissue of bark which runs under the base of the leaf-stalk, and when sufficiently formed detaches the leaf from its twig. He had found a similar additional growth of tissue at the points where an oak-twigg may be so easily severed. In the oak it is usual

to find four or five terminal buds growing in an axil, and at this point there is an active formation of tissue. There is frequently also a lateral bud just below the axil, and the growth of the twig is thus often driven into a lateral direction.

Mr. Sydney Webb exhibited a living specimen of *Sarrothripta revayana* caught on the 12th October at Redstone, thus confirming Brewer's record of this moth.

EVENING MEETING, *Nov. 10th*, 1876. Mr. A. J. Crosfield exhibited specimens of the following plants found by himself in this district; *Anthemis tinctoria* found on Reigate Hill; *Alyssum calycinum*, a plant common in the south of France, found in a clover-field on Reigate Hill; *Campanula hederacea*, formerly found on Reigate Heath but supposed to be extinct there; it has re-appeared in some abundance the last two years; *Lepidium Draba*, a plant found in the south of Europe; this has been observed abundantly on the railway bank between Forest Hill and New Cross, not strictly within our district; *Petroselinum segetum* found by the roadside on Wray Common, not mentioned in the "Flora of Reigate;" *Senebiera Coronopus* which has been found in various localities in the neighbourhood; *Epipactis latifolia*, and *Epipactis media* var. *purpurata*, found in Gatton Wood. Dr. Bossey mentioned localities in other parts of the country where he had found many of these plants, and made some remarks on the various causes for the rarity of different species. He also mentioned having found *Salvia pratensis* in Gatton Park.

Mr. Sydney Webb exhibited feeding larvæ of *Coleophora albicans*, a *Tineina* new to the Reigate fauna. They were found on *Achillea Millefolium* at Redstone in the present month.

Dr. Bossey read a paper on Diatoms, which he illustrated by numerous specimens exhibited under the microscope. In reference to the advance made in the knowledge of Diatoms, he stated that owing to their minuteness, they were entirely unknown till discovered by the aid of the microscope, the first known species, *Gonphonema geminatum*, having been discovered in 1773 by O. F. Muller. Fifty years ago, the number of known species was only 49; now the European species are computed to number about 4000. He explained the structure, mode of propagation, and habitats of Diatoms, and stated the grounds on which they have finally been considered to belong to the Vegetable Kingdom. He also alluded to their use as test objects in ascertaining the magnifying and defining powers of a microscope, many of the species being marked with regular transverse lines. He gave a table of some of the species found in this

neighbourhood, with the distance apart of the transverse lines, ranging from *Navicula cuspidata* which has 33 transverse lines in the $\frac{1}{1000}$ of an inch, to *Amphipleura pellucida* which has 92. Owing to the indestructible nature of the silex, diatom frustules often accumulate in large quantities in lakes, &c., forming deposits of considerable thickness. The city of Richmond U. S. A. is built on such a deposit of 18 ft. in thickness, and similar beds are met with in various parts of Europe.

EVENING MEETING, *Dec. 8th, 1876.* A microscopical exhibition took place, at which nine microscopes and a considerable variety of objects were shown by members and their friends.

PUBLIC LECTURE, *Jan. 19th, 1877.* A lecture was delivered to the members of the Club and the public, by Henry Seebohm, Esq. of Sheffield, entitled "A Journey of Discovery to North Eastern Russia and the shores of the Arctic Sea." The lecturer stated that up to 1875 there were six species of birds which were well known as winter visitants to this country, but of whose eggs there were no properly authenticated specimens, and whose breeding-places were not certainly known. These were the Little Stint, Gray Plover, Knot, Curlew Sandpiper, Bewick's Swan, and Sanderling. The object of Mr. Seebohm's journey in the summer of 1875 was to endeavour to trace some of these species at their breeding-grounds and obtain specimens of their eggs. He travelled via Archangel to the River Petchora, down which he sailed in boats to its Delta, where he was fortunate enough to discover the eggs of three of the above-named birds, viz. the Gray Plover, Little Stint, and Bewick's Swan. In the course of his journey down the Petchora he met with a bird—the Petchora Pipit—at first believed to be a new species, but which, he stated, had very recently been ascertained to be identical with a species obtained from the Malay Peninsula and occasionally elsewhere in Asia. Mr. Seebohm also gave many very interesting particulars of the natural features of the country, the customs and manners of the inhabitants, and the difficulties and adventures met with.

EVENING MEETING, *Feb. 9th, 1877.* Mr. W. H. Tyndall gave an address on the subject of Rain. He alluded first to the tropics as the great source of rain, owing to the large extent of ocean, and especially to the great heat producing a large amount of evaporation. He then spoke of the effect of the trade-winds, and of forests and mountain ranges in controlling the rainfall in various countries, and explained the theories which are advanced to account for the origin of the rain supply of Europe, and the course by which it is brought

from the South Atlantic. He spoke of the principal rainless districts of the earth, and of those where the rainfall is most abundant, and entered in some detail into the distribution of rain in Great Britain, giving also some statistics as to the recent rainfall at Redhill.

Mr. Sydney Webb also furnished statistics of the rainfall at Redstone Hill for the year 1876:—

January ..	1·300	July.. ..	·573
February ..	3·310	August ..	3·700
March ..	3·280	September	3·305
April ..	2·475	October ..	1·835
May ..	1·100	November	3·500
June ..	1·597	December	7·500

Total .. 33·475 inches.

Rain or snow fell on 223 days, against 216 in 1875, and 229 in 1874. The heaviest fall was ·82 inch on the 22nd June. In London the greatest falls were on Dec. 23rd, rain and snow 1·61 inches, or nearly an inch more than the quantity at Redhill; and on March 12th, ·74 inch, against ·16 inch at Redhill. The December rainfall is the largest recorded in one month in this neighbourhood for at least fifteen years. The Redhill rainfall was in excess of that of London every month except July, the total surplus being 8·23 inches. A very distinct aurora was observed on Dec. 15th.

Dr. Bossey exhibited an immense mass of individuals of *Plumatella cristata* (Lam.) found in a stream at Betchworth by Mr. Kensit. It considerably resembled a piece of sponge, and when alive must have contained a vast number of animalcules.

EVENING MEETING, *March 9th*, 1877. Mr. Edward Bidwell of London exhibited a large and valuable collection of eggs, for the purpose of illustrating variation in coloring and marking. About 50 specimens constituted a very fine series of the eggs of the Peewit, and included all kinds of varieties in color, form, and size. Amongst the other species which exhibited the greatest variations were the eggs of the Kestrel, Redshank, Common and Arctic Terns, Black-headed Gull, Herring Gull, and Common Guillemot. He alluded to the two classes of spots on eggs, the shell spots and surface spots. In the former the coloring matter is deposited during the formation of the shell; in the latter during the passage of the egg through the oviduct. Clearly defined spots or lines on an egg seem to prove that the coloring matter was deposited while the egg was at rest. When this is not the case the spots appear more or less smeared and blotched. A bird in the prime of life is found to lay the most richly

colored eggs. It has been ascertained by means of the spectrum that seven well-marked substances enter into the composition of the coloring matter of the shells of eggs, and that the various shades of color observable in different eggs are all due to the presence of one or more of these pigments in various proportions. The red is found to be derived from blood-secretions, and the blue and yellow from bile-secretions. The grain of the shell varies very greatly, from the rough surface of the egg of the Emeu, or the chalky egg of the Cormorant, to the wonderfully smooth and glossy surface of the egg of the Tinamou. The shape is equally various, from the almost spherical eggs of the Owls and other birds of prey, to the long eggs pointed at both ends laid by the Grebes, or the pyriform eggs of many of the Waders. Owing to this pyriform shape the bird is able to cover much larger eggs than would be the case if they were oval, as the four eggs when placed with the points together occupy a minimum of space. In connection with this it must be noted that the young of most of these species begin to run almost as soon as they are hatched, and are consequently more fully developed at their birth than many other birds. There also seems to be some relation between the number of eggs to be covered, and their size; thus the egg of the Snipe is about the same size as that of the Partridge, the bird itself being far smaller; but the Snipe invariably lays four eggs, while the Partridge often lays twelve or more. Again the Guillemot which lays only one egg, is a bird about the same size as the Raven, yet in the size of their eggs there is a very wide difference, the Guillemot's being many times the larger.

EVENING MEETING, *April 13th*, 1877. The subject of "Pond Life" was considered, being introduced by a paper read by Mr. H. E. Cox on the Coleoptera of ponds. These might conveniently be arranged in three divisions, according to their mode of life, viz. 1st. Those found in or on the water itself. 2nd. Those found in the banks of the pond, or in marshy ground at the margin of the water. 3rd. Those found in or among aquatic plants. Mr. Cox then described the structure of the first of these groups, showing how admirably it is adapted to enable them to live in and move through the water; and explained the mode in which the oar-like legs act as propellers, and also the provision for breathing beneath the water. Under this group he alluded especially to the Dytiscidæ and Gyrinidæ, and then touched upon the most noticeable points relating to the other two groups. Speaking generally of aquatic Beetles, it might be said that those which swim in water are of a black or dark brown color; those found on plants under water are lightish brown, often with iridescent reflection; and those found on the leaves of plants above the water are brightly metallic.

Mr. Sydney Webb referred to the Lepidoptera of ponds, of which however but very few can be strictly called aquatic, and of these only one is British, the well-known *Acentropus niveus*, which is now finally accepted as belonging to the Lepidoptera. He read extracts from several works in reference to other orders of insects which include aquatic species.

Dr. Bossey then read a paper on the minute forms of pond life which seem to occupy an ill-defined border land between the animal and vegetable kingdoms, illustrating the subject by a number of specimens exhibited under the microscope. He referred first to the families of the Desmids and Diatoms in the vegetable kingdom, and next to the lowest forms of animal life, alluding first to the Rhizopoda which he characterized as exhibiting life without structure, digestion without stomachs, and motion, progression, and prehension without muscles or limbs. In this division he referred especially to the *Proteus* or *Amœba* and to *Actinophorus Sol*, the Sun Animalcule. He then spoke of the Infusoria, and the Rotifera, explaining the structure and mode of locomotion of each, and lastly alluded to the Tardigrada or Water Bears.

Mr. J. B. Crosfield exhibited specimens of *Pesiza macrocalyx*, a fungus which he had found abundantly in a wood among fir-trees at the north of Box Hill. It was of a dull purplish color, and was growing partially buried in the ground. In fully expanded specimens the pileus was broken round the edge into a star-shaped form.

ANNUAL GENERAL MEETING, Oct. 19th, 1877. The Annual Report was presented, read, and adopted. It stated that six Excursions were made by the members during the summer, viz. on May 12th to the Holmwood; June 9th, Gomshall and Hurtwood; June 23rd (afternoon excursion) Reigate Hill and Betchworth; July 14th, Rockhurst and Balcombe; Aug. 11th (afternoon excursion), Merstham and White Hill; and Sept. 8th, Ranmer Common and Box Hill. At the Holmwood some tubes were observed on sloe bushes made by the larvæ of either *Rodophæa suavella* or *Sideria achatana*, either of which would be new to the district. Several specimens of *Lithocolletis hortella* were also found on the trunks of some large oak trees. This species of moth is new to our district, not having been previously taken nearer to our limits than St. Martha's Hill, Guildford. Among furze on a common near Hurtwood, *Orobanche major* was found in great abundance. *Hymenophyllum tunbridgense* was found to be still growing in profusion on the rocks in the grounds of Charles Hill, Esq. at Rockhurst, the only station for it in our district. The geological

structure of these rocks which belong to the Hastings Sand series, was of much interest, many of them being of fantastic shapes, and bearing evidence of having been subjected to the action of water, by which the softer parts had been worn away, and the harder portions left protruding. Near Merstham, on a ridge formed by the outcrop of the firestone, were found *Lathyrus sylvestris* and *Astragalus glycyphylus*. At Dorking a new cruciferous plant allied to *Alyssum* was found growing in a clover field; it was afterwards identified as *Berteroa incana*, and had doubtless been imported with foreign seed. On a hillside north of Ranmer Common, *Hypericum calycinum* and *Aquilegia vulgaris* were found growing together in great abundance. The Report also recorded the proceedings at the Evening meetings of the Club. Among the donations received was a copy of the "Synopsis of the British Hemiptera-Heteroptera," by Mr. Edward Saunders.

The Treasurer's Statement of Accounts for the past year, duly audited, was presented, as follows:—

	£	s.	d.		£	s.	d.
Sept. 29, 1876. To Balance				1877. By Rent, Gas, Firing			
in hand.....	16	5	0	and Cleaning ...	17	4	8
1877. To Subscriptions ..	29	1	0	„ Attendance at			
				Museum (2 yrs.)	13	1	0
				„ Collector's com-			
				mission, Printing,			
				Postage and			
				Sundries	5	19	4
				Oct. 1. Balance in hand..	9	1	0
	£45	6	0				
					£45	6	0

The following gentlemen were then elected as officers for the ensuing year, viz: as President, Mr. Sydney Webb; Treasurer, Mr. R. C. Baxter; Secretary, Mr. J. B. Crosfield; Curator, Mr. J. Linnell, jr.; Members of the Committee, Dr. Bossey, Dr. Holman, Mr. E. Chambers, Mr. T. Cooper, Mr. H. E. Cox, Mr. A. J. Crosfield, Mr. A. Keene, Mr. C. Marshall, and Mr. W. H. Tyndall.

The meeting was then resolved into an ordinary Evening Meeting.

Mr. Baxter exhibited a drawing of a *Deodara* in his grounds, round which when a young tree twelve years ago a wire had been fastened. This had subsequently escaped notice, but was at last observed and removed when too late. The stem immediately above the wire had swollen into a sort of bulbous-shaped excrescence, and the leading shoot above it had gradually withered and died, the tree in the meantime having put forth two new leaders, one on each side, below the wire. Dr. Bossey referred to the mode of growth fre-

quently found in the oak and the black poplar as due to natural causes of a somewhat similar kind; in these trees the central bud of a twig often dies, and the lateral one flourishes, thus producing an angular growth.

Mr. Tyndall presented some particulars relative to the rainfall and readings of the Barometer and Thermometer for the months of May, June, July, and August.

EVENING MEETING, Nov. 9th, 1877. It was reported that one collection of Insects and three collections of Plants had been sent in, in response to the offer of Prizes made by the Committee in February. The first prize for Insects was awarded to Mr. Edwin Ashby. For the collections of Plants the first prize was awarded to Miss Margaret C. Crosfield; the second to Mr. A. Polley; and the third to Mr. Jabez E. Howe. Dr. Bossey stated that the collection of Mr. Howe contained a specimen of *Galeopsis versicolor*, gathered near Nutfield, which was a plant not previously recorded as occurring in the district.

Mr. Sydney Webb read a paper on the Entomological features of the year, which he characterized as having been very nearly unproductive as regards insects worth recording. He attributed this to the mildness of last winter, and the subsequent unfavorable weather, past experience having shown that a severe winter is usually followed by a season of good collecting. It is deserving of notice that wet winters and springs destroy an immense amount of insect life; and as a large proportion of this would be injurious if preserved, they are in this sense beneficial. The writer referred to the failure of the fruit crop as due rather to meteorological than to entomological causes, and spoke of the Codlin moth (*Carpocapsa pomana*) and its congener, *C. pruniana*, which latter may be expected to be rare for some years to come, owing to the scarcity of stone fruit. The great feature of the year has been the extraordinary abundance of the Clouded Yellow (*Colias Edusa*), which has been met with throughout the United Kingdom. In August the variety *Helice* was observed in considerable numbers; intermediate varieties were also met with, and some other curious forms, as for instance, *Edusa* with *helice* stripes or spots on the disc; *Edusa* with one wing only *helice*; *Edusa* with one side *helice* and the other normal; and one taken near Dorking has the hind wings alone of the deep color, the fore wings being *helice*. The writer then alluded to the causes of variation, and expressed his opinion that while the actual causes are remote and indeterminate, there is usually an increased tendency to vary in bad collecting seasons; as a mild wet winter which tends

to destroy insects in the immature state probably has its effect in abnormally developing some of those which survive and emerge as perfect insects. He further referred to the great abundance of the *Tineinæ* or Clothes Moths as one peculiar feature of the year.

EVENING MEETING, *Dec. 14th*, 1877. Dr. Bossey read a paper on the Circulation of the Sap in Plants. He spoke first of the structure of the fibres of the root, and of the action that takes place when they come in contact with the moisture of the soil, the first absorption being due to Endosmosis, the upward movement of the fluid being afterwards aided by capillary attraction. He also explained in detail the other causes which operate to produce the ascent of the sap, and the modifications it undergoes in its progress, and especially when it circulates through the leaves of the plant, where it loses a large part of its water by evaporation during the day, and receives the addition of hydro-carbons formed from the decomposition of water and carbonic acid, and is then fully prepared to supply nutrition and tissues to the plant. Dr. Bossey then referred to the descent of the sap, a process which although denied by many modern physiologists, he considered had been fully established by observation and experiment. Taking this view, he spoke of the causes which conduce to its descent, including the contraction of the leaves at night owing to the lower temperature, also the abundant absorption of water at the same time through the cuticle and hairs of the leaf; and when it descends further, flowing between the bark and wood, capillary attraction and gravitation both operate to accelerate its descent. During its downward course it is continually drawn off on the one side by the medullary rays to supply nourishment to the wood, and on the other to maintain the growth and substance of the bark; this constant demand upon its volume contributes to cause a further flow from above downwards, and may indeed be considered as the main cause of its descent. Dr. Bossey then adduced various facts in support of the views taken in his paper; for instance, if a stem with colored juice be cut, the lower surface of the cut is seen to give but little juice as compared with the upper. Berthollet says that people in the Canaries tear off the bark of a poisonous *Euphorbia* and then suck a limpid and harmless sap from the stem. Increase of wood may be prevented by cutting off an annular portion of bark; and the same occurs if a brass plate is placed between the bark and the wood, wood being then formed only outside the plate. The success of budding trees depends on the same circumstance, the tongue of inserted bark conveying sap to the inserted bud. If a stem be tightly girt by a ligature it swells and forms new wood above the band, and scarcely increases in diameter below it. De la Baisse caused a *Euphorbia* to pump up

water colored red. The liquid ascended in the wood, and tinged the leaves, and the color spread downwards in the bark. Several experiments were instanced which tend to show that leaves exhale much moisture during the day; and similar cases were mentioned showing the action of the capillary vessels of the roots in absorbing moisture.

Mr. J. B. Crosfield read some notes on Ornithological observations made during the past year. He gave particulars as to dates of migration, songs, and nesting of various species as noticed by himself, and also respecting observations of the Brambling, Woodlark, Dartford Warbler, and other birds. He also exhibited a specimen of the Gray Phalarope which was shot while swimming in a brook, at Ham Farm, near Redhill, by Mr. J. G. Marriage on the 16th October last, the day following a severe gale. He also gave the following particulars of the occurrence of rare birds in this neighbourhood, as supplied to him by Mr. Reeves, of Holmesdale Road, by whom the specimens had been preserved; viz. a pair of Black Terns shot by a man named Apps, at Earlswood Pond, in September, 1875, and since seen and identified by Mr. Howard Saunders; a Peregrine Falcon shot at Clay Hall Farm, in October, 1876, by Mr. Williams; a female Great Gray Shrike caught alive near Flanchford Bridge on the 21st November last; this bird died shortly after, being apparently diseased; a male of the same species caught in a trap at Buckland, a few years ago; and several other species.

EVENING MEETING, *Jan. 11th*, 1878. Mr. Fleming exhibited a number of specimens of Australian birds, comprising about 30 species, and made some observations in reference to their most striking characteristics. He also exhibited several Marsupials and other animals from Australia.

Mr. Sydney Webb exhibited the following species of Lepidoptera for record; viz. *Coleophora ochrea* taken in April and August, 1877, on the Downs at Caterham Junction; the species of this genus have not hitherto been supposed either to hibernate or to have more than one brood in the year, but these captures would point to one or the other cause, which further investigation must decide; *Nephtica arcuata*, and *Antispila Treitschkiella*, rare *Tineinæ* from Reigate Hill.

Mr. Sydney Webb also read some statistics and other particulars relating to the meteorology of the year 1877.

The Rainfall of the year was as follows:—

January ..	7.070	July ..	3.740
February ..	2.550	August ..	2.705
March ..	3.165	September	1.535
April ..	4.410	October ..	2.545
May ..	2.800	November	5.775
June ..	.625	December	2.500

Total .. 39.420 inches.

Rain or snow fell on 220 days as against 223 in 1876, and showed an excess of 4.95 inches. The total is the largest since the year 1872. The greatest amount that fell in one day was $1\frac{1}{2}$ inches on the 11th November; the quantity measured in London on the same day was .875 inch. In 1876 the heaviest rainfall in one day was .82 inch; but last year this amount was equalled or surpassed six times. In January rain fell on 29 days, and in June on 7 only. Our rainfall was in excess of that of London every month except July, when thunderstorms occurred there from which we were free. Some particulars were also given respecting some periods of extraordinary barometrical depression and excitement.

EVENING MEETING, *Feb. 8th*, 1878. Mr. J. B. Crosfield and Mr. Edwin Ashby exhibited a number of fossils from the Gault formation, which had recently been obtained near Gatton Corner, where drainage excavations have been going on. The most abundant shell was *Inoceramus concentricus*, specimens of which were in some lumps of clay crowded thickly together.

Mr. Sydney Webb read a paper on the "Gault of Redhill." After describing the manner of deposit and the character of the organic remains of the Gault, he proceeded to say that in this neighbourhood it may be divided into three sections. The upper portion (which is not always present, having sometimes been removed by superficial drift action) is pale drab in color, varied with yellowish pale brown. Its fossils are numerous and irregularly distributed. It is very adhesive when wet, but crumbles away when dried in the sun. Sometimes it has been mistaken or worked for fire-brick earth, but it is almost worthless for that purpose except in neighbourhoods where through scarcity of that article an inferior quality commands a market price. The second section consists of a bluish gray or dark-blue earth, but paler in color when dry. It contains alternating beds of *Inocerami* and *Ammonites*, the former very numerous, crushed together into a band sometimes of considerable thickness, the lower part of the bed often almost wanting in other fossils. The lowest division of the Gault consists of a

clay, laminated, streaked, or interspersed with fine sand, with septaria and minute crystals of barytes, with occasional nodules, veins, or spaces of bright green sand, being the only highly colored specimens in our neighbourhood suggestive of the term Greensand, applied to the stratum next inferior. Amongst the fossils obtained from the Gault exhibited by Mr. Webb were 4 species of Zoophyta, 4 Echinodermata, 3 Annelida, 3 Cirrhipedia, 5 Crustacea, 12 Monomyaria, 11 Dimyaria, 24 Gasteropoda (including 5 species of Dentalium, and 5 of Trochus), 26 Cephalopoda (including 6 Hamites, 16 Ammonites, and 3 Belemnites); also teeth of Sharks and other fishes.

EVENING MEETING, *March 15th*, 1878. Mr. J. E. Howe exhibited a specimen of Ammonites Nutfieldiensis (a fossil said to have been first found near Godstone) from the Fuller's Earth Pit at Nutfield, and also other fossils from the Lower Chalk and Lower Greensand.

Mr. Tyndall read a paper on the Beech-tree, in which he treated of its geographical distribution, the various characteristics of its mode of growth, its wood and the uses to which it is put, and other points of interest, referring also to some of the most remarkable Beeches in different parts of England.

EVENING MEETING, *April 12*, 1878. The President (Mr. Sydney Webb) exhibited a polyanthus having a hollow stem with another stem inside it, and having the appearance externally of a fasciated stem.

The President then read a paper on "Shell-bearing Animals (Mollusca) recent and fossil." He referred successively to the various classes into which the Mollusca are divided, pointing out the main characteristics of each, viz. the Polyzoa or Bryozoa, the Tunicata or Ascidians, the Conchifera including the shells commonly known as Bivalves, the Brachiopoda or Lamp-shells, the Pteropoda, the Gasteropoda in which he remarked that a considerable development in structure is apparent, a distinct head and some organs of sense being present; and lastly the Cephalopoda. He alluded in some detail to this class and to the two orders of which it consists, of the first of which the Cuttle-fish may be taken as a representative, and of the second the Nautilus. He described the structure of each of these groups, and also of their respective sub-divisions, the subject being abundantly illustrated by specimens.

ANNUAL GENERAL MEETING, *Oct. 11th*, 1878. The Annual Report and statement of accounts were read and adopted. The Report stated that during the summer the following excursions were

The following gentlemen were then elected to serve as officers for the coming year: President, Mr. Sydney Webb; Treasurer, Mr. R. C. Baxter; Secretary, Mr. J. B. Crosfield; Curator, Mr. J. Linnell, jr.; Members of the Committee, Dr. Bossey, Dr. Holman, Mr. Chambers, Mr. Tyndall, Mr. T. Cooper, Mr. Cox, Mr. Marshall, and Mr. A. J. Crosfield, one place being left unfilled.

The meeting was then resolved into an ordinary Evening Meeting.

Mr. Tyndall presented a summary of the Meteorology of the year 1877, as observed by himself at Oxford Road, Redhill, and also a statement of meteorological facts of interest for the months of June, July, August, and September, 1878.

1877.	Barometer at 8 a.m.		Thermometer.		Rain Total.	Greatest fall in one day.	No of days on which rain fell.
	Maxi- mum.	Mini- mum.	Maxi- mum.	Mini- mum.			
January	30·57	28·82	52	27	6·86	1·06	27
February	30·30	29·12	57	22	2·41	·56	20
March	30·31	28·93	56	23	3·03	·38	20
April	30·17	29·22	63·5	32·5	4·13	1·17	20
May	30·30	29·31	65	27·5	2·46	·36	16
June	30·26	29·57	82	42	·77	·28	7
July	30·31	29·29	83	45·5	3·64	·92	13
August	30·18	29·55	79	40	3·14	·78	16
September	30·34	29·66	72	35	1·50	·72	11
October	30·58	29·32	65	26	2·36	·39	13
November	30·40	28·87	57·5	29	6·50	1·36	24
December	30·60	29·22	54	25	2·27	·74	16
39·07						203	

Mr. Linnell presented to the Club a copy of Bentham's "Illustrated Hand-book of British Flora" in two volumes.

The President brought for exhibition and record the following Lepidoptera taken in our district, to which all of them are new; *Eremobia ochroleuca*, *Cheimatobia boreata*, *Coleophora argentula* (larva previously exhibited), *Eupithesia debiliata* (bred from larva taken at Leith Hill), *Gelechia distinctella*, *G. celerella*, *G. instabilella*, *G. nigritella*, *Phyllocnistis salignella*, *Phycis Betulæ*, *Bucculatrix Demaryella*, *Pterophora teucriti*.

EVENING MEETING, *Nov. 8th*, 1878. The President announced that the Committee had awarded Prizes to the following competitors, for collections sent in, in response to the offer made by the Committee; for Botany, 1st prize to Miss Eliza Wilson, Springfield Villa, Reigate; 2nd to Mr. E. P. Collett, Grammar School, Reigate; 3rd to Miss Rosa Marriage, Dunedin, Meadvale; for Entomology, 1st prize to Mr. Edwin Ashby, Bridge Road, Redhill; and for Geology, a 3rd prize also to Mr. E. Ashby.

Mr. Tyndall read a paper on the Yew-tree, describing its manner of growth, the characteristics of its bark, wood, foliage, &c. He referred to the great age attained by this tree, and enumerated a number of well-known Yews remarkable for their age or size. He also referred to the practice of planting Yews in churchyards, which appears to have been adopted from the custom of the Greeks and Romans, who planted the cypress as an emblem of immortality. The poisonous nature of the leaves, especially after being clipped some time was also mentioned, and the circumstance that goats and some other animals are said to eat them with impunity.

PUBLIC LECTURE, *Dec. 13th*, 1878. A Lecture was delivered by Henry Seebohm, Esq. F.Z.S. of London, entitled "Six Months in Siberia." Mr. Seebohm's visit took place in the year 1877, his principal object being to pursue investigations in Natural History, and to collect specimens, chiefly of birds and their eggs. He gave graphic descriptions of incidents in his journey, the break-up of the ice on the River Yennesay, the immense flocks of migratory birds such as Swans, Geese and Ducks, and the suddenness with which winter gave place to summer. Amongst the eggs obtained by Mr. Seebohm were those of the following species of birds, which up to that time had not been obtained, viz. *Phylloscopus borealis* (Blas.), *Phylloscopus tristis* (Blyth), *Charadrius fulvus* (Gm.), *Turdus obscurus* (Gm.); also *Emberiza pusilla* (Pall.), and *Anser ruficollis* (Linn.), only taken by Middendorf, 25 to 30 years ago; *Cygnus minor* (Pall.) and *Tringa minuta* (Leist.), only previously taken by Mr. Seebohm and Mr. Harvie Brown on their visit to the Petchora in 1875; and *Phylloscopus superciliosus* (Gm.), the eggs of which had previously been taken by Brooks in Cashmere.

October 46.

March 1880.





PROCEEDINGS

OF THE

Holmesdale Natural History
Club,

REIGATE,

FOR 1879 AND 1880.

REDHILL:

"MIRROR" STEAM PRINTING WORKS, BRIGHTON ROAD.





PROCEEDINGS

OF THE

Holmesdale Natural History Club.

EVENING MEETING, *Jan. 10, 1879.* Dr. Bossey read a paper on the subject of the "Relations Subsisting between Water and Growing Plants," as follows:—

These relationships are highly important in a social or economic point of view, as they are intimately connected with the cultivation of our garden and cereal crops, the drainage of land, the purification of our rivers, and the right appropriation of the sewage of our towns; but it is only as a question of science or natural history that I can deal with this subject this evening, and in this aspect it is sufficiently interesting to command our attention, since every plant, from the first germination of its seed to its final decay, and every physical, chemical, or vital process going on in every plant, is more or less connected with its relationships to water. The germination of seeds is wholly dependent on it, for so long as a seed remains dry it undergoes no change, even if buried in the earth; but if the soil be moistened the seed swells, its tissues soften from water taken into its substance, part of the water is decomposed, its oxygen uniting with the carbon in the seed to form carbonic acid, which escapes into the soil and the air, and part of it is combined with the starch present in the seed and converts it into sugar, a change which consists wholly in the addition of water—

Starch containing 12 parts of carbon and 10 of water.

Cane Sugar containing 12 parts of carbon and 11 of water.

Grape Sugar containing 12 parts of carbon and 14 of water.

The same change takes place in the ripening of dates, apples, and pears. In the unripe state these fruits contain starch, and the process of ripening consists in the conversion of this starch into sugar by its gradual union with water, so that the sweetness of the fruit when ripe is proportioned to the quantity of starch in it in the unripe state. After having thus aided the germination of seeds, water is still an essential constituent of growing plants. In these it takes up from the earth and conveys into the plant such matters as are required for its support; it keeps up in the sap that degree of fluidity which is needful for its circulation; and it maintains in the tissues that moist condition which enables them to imbibe and transmit the fluids with which they are in contact, as well as to effect certain

chemical changes in those fluids. Each of these topics requires a few remarks, and first I shall speak of the way in which the roots obtain water from the soil, holding food elements in solution. (1.) The water is derived from rain and dew. These rains and dews collect ammonia and carbonic acid from the atmosphere, and carry them down into the earth. (2.) Earthy phosphates, silicates, and other matters essential for plants exist in the earth, but mostly in an insoluble state, and therefore not available for growing plants. (3.) The ammonia and carbonic acid brought into the soil by the rain and dew have the power of rendering these insoluble silicates and phosphates soluble in water. (4.) Solutions of silicates, earthy phosphates, and salts of ammonia filtering through ordinary soil deposit the matters they contain in solution on the surface of the particles composing that soil, and allow the water to pass on in a purified state. (5.) The rootlets of plants penetrating between the particles of soil are at one and the same time brought into contact with the matters thus deposited (which constitute the nourishment of plants) and with water containing carbonic acid, by which that matter is made soluble. (6.) The solution so made, and so brought into contact with the rootlets, is absorbed by them and conveyed into the plants as sap. The amount of water supplied to plants has much influence on the rate of their growth, on the tissues they develop, and on their general habit and strength. An abundant supply of water produces weak succulent stems, abounding in leaves, but deficient in fruit. A dry season produces the best fruit and the richest harvests; old and dry seeds of melons and cucumbers grow less vigorously than recent ones, but bear better crops of fruit; shrivelled seeds of stocks produce double flowers, while plump and moist seeds grow plants bearing only single flowers. The benefit of transplanting depends in part on the fact that some of the roots die, and by their decay extricate carbonic acid, which, by rendering soluble the otherwise insoluble constituents of the soil, accumulates nourishment in the fittest state for absorption by the newly formed rootlets, at the very spot where it is required. After its absorption by the roots the sap ascends through the stem to the leaves. In its course it is subject to various movements, and undergoes different modifications of its composition. In all of these changes water forms an important agent. It gives to the sap that degree of fluidity which enables it to rise with the necessary rapidity in the capillary tubes of the stem; to pass by slower degrees from cell to cell, by virtue of the permeability of the cell membrane; to produce the varieties of cell circulation, cyclosis, and rotation; and to assist in the elimination and transport of the various secretions. To show the need of this water-given fluidity to the sap, I need only mention that the rate of its ascent has been ascertained to be 40 inches per hour in the cherry laurel, and even as much as 15 inches per minute in the sun-flower. The slower passage of the sap from cell to cell implies not only the permeability of the cell wall to watery fluids, but also, as I imagine, some special relationship or adaptation in the cell membrane to this particular purpose. I can neither explain

nor define the nature of this adaptation, but I think it is plainly indicated to us in the sensibility which some plants show to the presence of water, and in the movements in them which are so readily excited by it. Examples of this sensibility are seen in the spores of *Equisetum*, the awns of *Avena fatua*, of *Erodium moschatum*, and in the pappus of compound flowers. According to Mirbel and others the emission of pollen-grains from the anther cells of plants is connected with and gives another illustration of the operation of this special affinity of cell-membrane for water. It is shown as follows: When the pollen is mature its grains become detached from the anther cell, but then their great affinity for water causes them to abstract it rapidly from the walls of the anther cell, which consequently contracts with such force that it bursts open and expels the pollen. These pollen grains so expelled give another and beautiful illustration of the same law, for falling on the moist surface of the stigma they are entangled by it. The grain of pollen so entangled absorbs moisture, which distends the grain and leads to the protrusion of a slender membranous tube, which travels down through the tissue of the stigma till it arrives at the ovule and fertilises it by discharging the fovilla. We come now to the leaves, where the sap is brought into contact with the air, and being subjected to new influences undergoes new changes, in all of which water plays an important part. The proportion of water to other parts of the sap is regulated, special arrangements for evaporation and absorption being in operation for this purpose. On the one hand evaporation is controlled by a layer of cuticular or epidermic cells, which is often covered by a secretion of wax. This cuticle varies in thickness and character in different plants, being very thick in some (as the oleander) usually growing in a hot and dry climate, and thinner in others growing in cool and moist places. On the other hand excess of moisture is provided against by the presence of stomata, which are specially designed for its escape. (I scarcely need observe that these stomata are valvular openings, usually most numerous on the under side of leaves, having free communications with the air-cavities of the plant.) The action of these stomata has recently been shown in a very beautiful manner by a writer in the *Comptes Rendus*, by the action of a test-paper prepared with perchloride of iron and chloride of palladium. This paper is white when dry, but becomes black as soon as it is moistened. A growing leaf placed between two folds of this paper blackened it very quickly on that surface and opposite to those parts at which the stomata were placed, so as plainly to prove that it was through them that the moisture was exhaled. Some degree of evaporation also takes place from all exposed parts of plants. Water is also absorbed by leaves—in a slight degree by the cuticular surface generally, and in a more marked way by the stomata, and by the numerous hairs and asperities with which they are so commonly provided. As I have already stated in this room, I believe one of the special purposes for which the hairs of plants are designed is the collection of moisture from the air, in order that it may be introduced into the sap; and it is highly probable that some other epidermic

cells, which only present themselves to our view as transparent empty cells, may answer the same purpose. Be this as it may, the absorption of water by leaves is abundantly proved by the refreshing influence of a summer shower on drooping plants, and by the effect of syringing the withering leaves of hothouse plants. The same thing is proved conversely by the fact that many plants will not live in the dry air of our sitting-rooms, and by the beneficial effects of placing moist tea-leaves around their stems.

The chemical relations of water to plants are no less numerous or important than the physical or vital ones of which we have spoken. It is a constituent of lignin, starch, sugar, and gum, or in other words these consist solely of carbon and water, or oxygen and hydrogen in the proportions to form water. Some bodies, as oil, contain more hydrogen, and others more oxygen than water, but all these are formed by the decomposition of water, and the fixing of its elements in such proportions as they are required. The coldness of the night reminds me that I ought to speak of the influence of frost on the tissues of plants, as this is one of the conditions in which water acts upon them; but I must confess that I am not sufficiently conversant with the subject to enter upon it. I have also omitted all allusion to water plants, as I did not intend to include them in my paper. Whether we look at the marvellous way in which a constant supply of food materials is brought to the immovable roots of plants; to the endless mutations to which that food is subjected in the economy of the plant; or to the extent to which the simple element of water is employed in all these wonderful operations, we must feel a deep interest in the subject, and an intense admiration of the infinite wisdom and power by which the whole has been designed and perfected.

Dr. Bossey exhibited various objects under the microscope in illustration of points alluded to in the foregoing paper.

Mr. J. B. Crosfield read the following paper, entitled "Notes on Ornithology," dealing with occurrences noted in the course of the past year:—

During the past year but few facts of special interest relating to birds have come under my notice, and I must therefore be pardoned if any of those I mention may appear trivial or unimportant. I entered in the Record-book belonging to the Club the dates on which I first observed the various summer birds of passage; I need therefore only say in regard to them that the more than usually severe weather which prevailed at the end of March and beginning of April probably retarded the arrival of many species, most being behind their usual dates. This, however, did not seem to interfere with nidification, as I observed a martin building on May 5th; found a sedge warbler's nest containing one egg on May 7th, near Rainham, Essex; and a turtle dove's with one egg on May 14th, in the New Forest. Of the winter migrants I was surprised to see four redwings as early as October 6th, which was a warm, summer-like day. At that time martins were still to be seen in abundance, and continued plentiful till October 13th, after which I saw no more, excepting three which were playing about for a long time on November 3rd. It is very unusual for the

summer and winter migrants to overlap so much as four weeks, as in this instance. Gilbert White alludes to it as an unusual circumstance when he saw martins and redwings flying in view together. At the time of the spring migration, however, it is not at all uncommon for both redwings and fieldfares to remain long after many of the summer migrants have arrived, and indeed up to a time when their relatives the thrushes, blackbirds, and missel thrushes have long hatched their young.

On several occasions in February I noticed hawfinches going in little companies, as many as eleven or twelve being at times together. Possibly they may flock somewhat in the winter, as most of the finches do more or less; only that, being less numerous as a species, the numbers that associate in any one district are usually only small. I found a nest of this species on May 4th, in the fork of a hornbeam, 40 or 50 feet from the ground, in exactly the same place where there was a hawfinch's nest several years ago, the old nest having remained there ever since. The materials now employed, however, all seemed new, so probably the birds had removed what remained of the old nest, and built a new one in the same site.

On June 1st I found a ciril bunting's nest, containing four eggs, in a juniper bush, about three feet from the ground. As there was a yellowhammer's nest built at the foot of a low bush at a very short distance, a good opportunity was afforded of comparing and contrasting the nests and eggs of the two species; the greenish ground colour of the ciril bunting's eggs being strikingly different from the pinkish or purplish tinge apparent in those of the yellowhammer. A long-tailed tit's nest was built in a small arbor vitæ in the garden, being nearly finished on April 6th. On the 14th I found that it contained four eggs; the two that I examined were pure white, without any spots.

I exhibit two eggs of the water rail, which I took on April 19th from a nest in the neighbourhood of Newbury, in Berkshire. Owing to the localities inhabited by this species, and its retiring habits, the nest is comparatively seldom met with. It was in a district where there were extensive meadows, intersected in all directions by innumerable clear, swiftly-running streams, both large and small, natural and artificially diverted. There were also in several places ponds, around and in which there were still standing immense quantities of dead reeds of last year's growth; and amongst these ponds were little copses of alder and other trees, and also tracts of marshy land, more or less covered with coarse herbage and dead rushes. Wild ducks abounded, and we found two nests containing eight and ten eggs respectively within a few feet of each other, on the ground, in a rather swampy place, well concealed by herbage. Almost close to these my brother noticed something moving among the rushes, and on looking, discovered a water rail's nest, very well concealed, containing nine eggs. The bird had slipped away so quietly that we could not obtain a view of it, but the eggs sufficiently proved the identity. The nest was cup-shaped, built and lined with dead rushes; it was raised some two or three inches above the swampy ground, and seemed to be supported by the stems of some plants growing beneath it, which must have been woven into its structure;

except for these one could pass one's hand along under the nest. The bird could be heard very near at hand making a most curious noise, perhaps best described by the word "grunting;" it was not unlike some of the sounds a cow sometimes utters, but it kept quite out of sight and would not show itself.

A gentleman of my acquaintance residing at Pinner, who may be thoroughly relied on as an accurate observer, recently informed me that a young cuckoo just fledged was last summer caught by his groom, by whom it had been driven out of a water wagtail's nest built against the side of an elm-tree near his house, at a height of about 8ft. from the ground. My informant had for some time observed the wagtails flying to and from this nest, as if engaged in feeding their young, but had not till then known that the nest contained a cuckoo. The young bird was put in a cage, and hung in a position at least 100 yards from the nest, and here it was constantly fed all day for more than a week by a robin, this being repeatedly witnessed by my informant himself. This seems to be but another instance of the mysterious fascination which the cuckoo exercises over other species of birds. The same gentleman also informed me that a pair of blue tits last year built their nest inside the letter-box in his front door. Letters were constantly put in as usual, but were invariably ejected by the birds through the slit in the door. It is difficult to imagine how such small birds could succeed in doing this, as some of the letters were of considerable weight, and it must have been no easy matter for a bird within the box to support the letter up to the mouth of the slit, at the same time holding it in the necessary position end first.

On the 27th December I noticed two or three lesser redpoles (a species I do not very often see here) at Merstham Pond, apparently finding some food in the dead seed vessels of the large willow-herb (*Epilobium hirsutum*).

Mr. Reeves of Holmesdale Road informs me that during the past summer two white martins were shot in this neighbourhood, and brought to him for preservation, one being now in his possession. This bird was shot on the 1st September at South Park, the other having been killed some time previously. After the first bird was shot, and before the second was shot, Mr. Reeves heard of a white martin being seen at Buckland Pond, at the chalk-pits on Reigate Hill, at Santon, at Betchworth quarries, and at Glover's Fields. A man also told him that he had seen a white "squeaker" (*i.e.*, swift) flying over Earlswood Pond, but probably he was mistaken as to the species. The area included within these various localities is probably some five or six square miles, and from these occurrences in different places we may perhaps derive a little information as to the range of individual birds, though it is of course not possible to say how much further its journeys may have extended. On Tuesday last, the 7th inst., a blackbird was brought to Mr. Reeves, which had been killed on the previous day, of which the sides of the head, the forehead, and part of the chin were pure white, the breast being pale with spots, somewhat resembling that of a hen blackbird. As the bird had a bright yellow bill, it was however no doubt a male.

Mr. Crosfield exhibited one of the white martins alluded to in his paper, and also other specimens of birds and eggs.

Mr. Tyndall presented a table of meteorological observations for the year 1878, made at Oxford Road, Redhill, a height of 300 feet above the sea:—

	Barometer.		Thermometer.		Rainfall.		
	Maxi- mum.	Mini- mum.	Maxi- mum.	Mini- mum.	Total.	No. of days when rain fell.	Greatest fall in one day.
January	30.58	29.37	53	23	1.64	14	.39
February	30.59	29.88	56	25	2.01	14	.41
March	30.55	29.16	57.5	21	1.21	10	.63
April	30.17	29.14	67	26.5	3.64	19	.94
May	30.12	29.35	71	38.5	4.12	27	.38
June	30.23	29.64	88	39	1.37	12	.32
July	30.35	29.71	84	45	.85	10	.17
August	30.09	29.38	77	48	5.88	21	1.01
September	30.28	29.50	74	37.5	1.36	11	.29
October	30.32	29.07	70	30	2.92	17	.72
November	30.37	29.30	51.5	25	4.88	22	.97
December	30.25	29.19	53	10	1.83	18	.60
					<u>31.71</u>	<u>195</u>	

EVENING MEETING, *Feb. 14th*, 1879. Mr. Turner exhibited a remarkably fine specimen of the fossil crushing teeth of *Ptychodus decurrens*, a shark nearly resembling the existing species known as the Port Jackson shark. The specimen was found at Betchworth. In the modern species the whole roof of the mouth and part of the throat are paved with stone-like teeth, adapted for crushing shell-fish.

The President (Mr. Sydney Webb) read the following paper on "The Phenomena connected with the Emergence of Lepidoptera from the Chrysalis:—"

Every insect, whether it be a fly, beetle, bee, butterfly, bug of either the water or land, grasshopper, froghopper, gnat, or what not, in passing through its short life occupies in succession one of four conditions; these are the egg, caterpillar or larva, chrysalis or pupa, imago or perfect insect; and whether we consider it in the first or last stage we shall find in different species diversity of structure and habit alike instructive and interesting. For instance, the egg—its mode of deposition how varied, its external covering how exquisite in its microscopic markings and sculpturings, the texture of the shells and the ways of the inmates, for some hybernate perfectly developed, whilst others remain unchanged for many months. Then the caterpillar, grub, or larva, with an invariable body of 12 segments, however diverse in form or eccentric in habit, turning to the pupa or chrysalis popularly considered as a fit emblem of life in death—no new figure, for it has been quoted alike by authors and poets, pagan, Hebrew and Christian, for the last 3000 years, as a familiar example of repose before the final change into a more glorified and perfected condition. I

say popularly considered, for natural history students very early learn that the chrysalis state is not one of utter quietness; indeed in some groups not only is there power of locomotion, but even of reproduction, as in the common *Blatta* or European cockroach, more familiarly known in our kitchens as the black beetle. These diverse habits in the immature condition attracted about 100 years ago the attention of two officers of the Austrian army, who were writing a book on the natural history of the neighbourhood of Vienna, and they adopted as their motto for the title page of their work, "One eye to the larva, and the other to the imago," and by this means succeeded in the discrimination of several nearly allied but obscure species. The idea once started was admitted to be a step forward in the science; it has ever since been recognised, and many good effects have resulted; but unfortunately it is easier to roll a cannon ball down hill than to stop it when in motion, and the consideration of the immature forms has been given more and more prominence, so that now they are almost allowed to take precedence over the imagos, and I fear much confusion is likely to arise in the future. Thus in the latest published work on the British butterflies there is an attempt to classify them not from peculiarities of structure or similarity of external form or colouring, but according to the mode of pupation; thus the 65 species are referred to three groups, viz., those suspended and girt with a thread around the middle as an additional support, *Detergentes*; those simply suspended, *Suspensi*; and those which change within a slight cocoon or web, *Celantes*. Distinctions such as these alone would lead us into terrible difficulties of classification, for habits of pupation vary even in the same family. Our common grayling (*Hipparchia semele*) would not apply to either group, as it changes to the pupa on the plain surface of the ground without the slightest cocoon or protection of any kind, and when we come to consider the hundreds of foreign species we should doubtless meet numerous instances with other peculiar and varied habits. But apart from this no such system could ever be adopted, for the very simple reason that original types and specimens have almost always been taken on the wing, and not reared in captivity, the life histories of the great part of the tropical species being absolutely unknown. I have thought it as well to refer to this proposed classification, if only to point out that one of these modes of pupation is unknown among moths, viz., the habit of suspending itself by the tail without any other support than that afforded by the microscopically minute hooks of the last segment; but whatever may be the position in this stage, that of the insect within the chrysalis always assimilates to the external appearance of its envelope; thus the wings are placed at the sides, slightly bent forwards, so that the costal margins touch near the tips. Within the space enclosed are the legs, whilst the tongue, unfolded and at full length, occupies the medial line; all these may be distinctly traced. The antennæ also are very visible, sometimes occupying a space by themselves on either side, at others almost covering, and hiding the other organs from view. The subject I intend to treat of,

however, is not the divergence of forms of the chrysalides, but the transition to the perfect insect, so that I will assume that development of the imago has duly taken place within the pupa (the physical consideration of which forms no part of our subject this evening). The actions then set up previous to extrusion are as follows:—1st, change of position; 2nd, change of colour; 3rd, appearance below the surface of imagal markings, or additional ornamentation of the pupa; 4th, transparency of eye-coverings and other parts of pupa-shell; 5th, lengthening of the abdominal segments, which last is generally immediately before emergence. Now the first remark on these changes is that there is a period of repose of uncertain duration between each. This must of necessity be for the purpose of re-adaptation and alteration of the internal fluids and viscera for the purpose they are finally destined to fulfil, an alteration better carried out in repose, as well as more consistent and certain in its effects; for we must reject Reaumur's theory that "all insects know the day of their final change, and that instinct teaches them to economise, or rather fill up the time leisurely." If this were so the duration of the pupal condition would always be the same, modified, but only slightly, by bad weather or drought, a state of things which we know to be at variance with our experience, and one which would lead to frequent extirpations of species, if not classes and orders. Further, these changes almost invariably occur in the order of rotation named, but from the different modes of pupation adopted they are necessarily but indistinctly seen, it being as little desirable to disturb pupæ as garden seeds when once below the surface of the ground. It would be taking up your time unnecessarily to enter more at length into these general movements, peculiarities in which I shall draw your attention to further on, but having mentioned different forms of pupation it will be desirable to see how far these affect the emergence of the insect. Of the Diurni the genera chiefly reared in confinement are *Papilio*, *Pieris*, *Melitæa*, and *Vanessa*. The changes they undergo are too well known to require attention, but the transitional stages of the equally common *Pyrarga*, *Egeria*, *Polyommatus*, &c., have been little cared for, and even the descriptions of the larvæ are copied from the works of continental writers. I myself have, through the kindness of a friend, made the acquaintance of some of these for the first time this year, and I take this opportunity to exhibit pupa-cases, which may interest those present. Where the pupa is suspended, as in the case of many of the Diurni, the colouring, by being intensified, often obscures the markings, which are thus lost sight of shortly before emergence, particularly of the dark-garbed species. The chrysalides of these common insects are but little known to English collectors, excepting by plates in text-books, though curious and interesting. That of *Tithonus* is a beautiful object, and one of the few instances we have of simple ornamentation in this phase of life. The late Mr. Newman, in his "History of British Butterflies," describes the colour of the chrysalis of *Tithonus* as almost white, tinged sometimes with green, and ornamented with numerous black markings, but that of *Janira* as pale apple-green, freckled with whitish or

yellowish green, and adorned with purple black markings; the fact being that he takes his description from the newly changed chrysalis of the one, but not of the other. The paler cream-coloured covers of the wings are very conspicuous in each of these, though more opaque in *Tithonus*. In *Janira* there is little other after-change of colour except a gradual fading out of the green in the abdomen, and consequent increase of the cream-coloured hue over the entire pupa-case until the morning of the third day before emergence, when an oval dark blotch, placed endways, appears on the centre of the inner margin, continually intensifying in depth of colour; this does not, however, seem to expand, but is ultimately absorbed in a cloud that comes over the middle of the wing-case. The change is gradual, and a very slow process, taking the whole of one day to complete, when the ocellus of the wing is distinctly visible; a small dot placed in the centre of the pupal wing-case, apparently for ornament, becomes at this time surrounded with a narrow red ring; the cream colour of the chrysalis, too, has deepened into a reddish buff. The next day the colour increases so much that the ocelli are no longer visible; towards evening a bluish bloom appears, the asperities of the cases show the minute white dots mentioned above, and finally the perfect insect escapes between 8.30 and 10.0 of the following morning, and is ready for flight the same afternoon. The fact of the pupa being suspended head downwards does not seem to interfere with the actual emergence at all, this being very rapid; when completed, the imago immediately turns round, and climbing up the pupa-shell, ascends to a favourable place for development. I wish particularly to draw attention to the oval dark mark on the inner margin of the wing-cases in this species; it is something very unusual, indeed, quite new to me, for I know no other insect where in progress of change for emergence a distinct mark appears on the pupa, not afterwards perceptible in any form in the imago. No such dark mark is seen when *Tithonus* approaches the period of perfection; the gradation of changes here affords nothing striking to record, excepting the lovely rose-colour of the pupa at one time, and increased number of markings on its external coat, such as may be often noticed on *Brassicæ* and *Cratægi*. Its final internal changes would also seem to be more rapid, as it is ready for flight within two hours from time of emergence. The motive power which enables the newly-born imago to force its way from the pupa shell has been suggested as something akin to hydraulic pressure. I do not think this explanation satisfactory, for the exudation from the body into the posterior segments of the chrysalis shell is in itself but small, as we may see upon after examination; its real use appears to me a lubricant, for when forced by pressure upwards it prevents adhesion between the as yet imperfect scales and the shell. If deficient in quantity a torn or more or less scaleless wing is the result, sometimes a total cripple. Passing to the *Sphingidæ*, the phenomena connected with the extrusion of the perfect insect are too well known to dwell on *in extenso*. In escaping, the portion of the chrysalis enclosing the head, antennæ, and legs is detached entire. I will only remark that *Ligustri* should be added to Dr. Swinton's list of stridulating

insects, the noise produced by it in the pupal state being equally discernible with that of *Convolvuli* or *Atropos*, though in a lesser degree. Many of the family bury themselves deeply in the soil when about to change to the chrysalis; others, often of the same species, wander so long after being full fed, that they will at last change under a few leaves, or even on the bare surface of the ground; these latter, I believe, sometimes appear in the autumn, or, if not destroyed by some of their numerous foes, in the ensuing year.

The long-vexed question of why these moths recur in numbers at irregular periods, I believe, is dependent on the depth to which the larvæ have burrowed and the weather of succeeding seasons. Unfortunately when a few years ago I made experiments on the subject, I had insufficient pupæ (only seven hundred in all) to finally settle the matter, though I bred imagos for three years in succession. This habit of burrowing is quite consistent with their great restlessness previous to the insect escaping from the pupa, as it would naturally bring the chrysalis nearer the surface of the ground. A similar movement is observable in many other families, such as *Cossus*, *Nonagria*, &c. Those who have bred *Sesia myopæformis*, *culiciformis*, or *chrysideformis* will have noticed the same thing; frequently the pupa, having released itself from its silk-lined chamber, will appear at the final hole of exit in the food-plant or stump for a succession of mornings previous to its emergence, falling back afterwards as though the weather were not sufficiently inviting. At times the pupa will so far protrude itself as to lose its balance, but in such cases I have seldom known the imago to emerge except as a cripple; indeed they seem to be very tender and impatient of the slightest touch, or even full exposure to the air. It is one of the peculiarities of this family that the insect can postpone the period of emergence from day to day without any perceptible ill effects; the morning sunshine is their delight, and their hour of birth from 8 to 9. One noticeable fact connected with it is the rapidity with which the final change takes place; owing to the movement to and fro of the insect's head the pupa-case gives way on either side of the antennæ in a very distinct manner; this portion is thrown backward, whilst the imago, propelled quickly forward, is forced from the chrysalis with a jerk, almost insensibly reminding one of the Zazel cannon trick. The strength of limb which they at once appear to possess is only shared, so far as I know, with the *Nepticulidæ*, who are even more active. Their wings are well developed and covered with transparent iridescent scales. In the necessary after development the wings do not rumple so much as other species, from the simple manner in which the nerve bones are arranged.

The emergence of *Lepidoptera* from the hard cocoons many of the species construct has frequently been considered by writers, but oddly enough no one seems to have taken the pains to verify their conjectures; thus errors of observation have been quoted and re-quoted for the last 150 years by different book-makers who have called themselves naturalists. Three probable modes have been suggested, viz.—(1.) That the chrysalis or imago has power to push its way out by main force. (2.) That a softening liquid is ejected from within,

dissolving the gluten of the cocoon and producing an aperture for escape. (3.) That the insect gnaws its way out. Now, rejecting the third opinion, which cannot be upheld in this order, the insects of which are without mandibles, we might perhaps be induced to refer to Hübner, who suggested their escape by cutting through the end of the cocoon by their eye-caps, or hard basal joint of the antennæ; but I fear I should be laughed at did I seriously show cause against such an argument, so we must proceed to an analysis of the first two; and in considering the primary suggestion, viz., that the chrysalis or imago has power to push its way out by main force we find at once various naturalists adhering to it from contradictory points of view. Some contend that the cocoon when first constructed is purposely left weaker in one part than another, thus allowing more readily the escape of the imago. This theory (though apparently easy of solution) has never been really proved, the nearest approach to it being noticed in the *Tineina*, which group is not the subject of the argument; and the genera *Bucculatrix* and *Nepticula*, to which I presume they refer, make their cocoons of woven, not of liquid silk, the former being of course far more flexible and elastic than the latter, and therefore more likely to yield to pressure from within. Others contend that the hard nature of these cocoons would imply a protection to the inmate from casualties and enemies from without, that the exterior would therefore necessarily be constructed firmer than the interior, and be an external defence only, weak in itself, but strong when supported by the inner part, which, yielding readily to pressure from within, would easily be broken through by the pushing of the chrysalis or perfect insect. I do not pretend to decide the quarrel, but will leave it to the room, adding the curious circumstance that each party points to the cocoon of the Emperor moth (*Saturnia carpinii*) as a case in point which thoroughly upholds its argument. Now shortly to look at the second suggestion, that the insect, by a softening liquid ejected when within, dissolves the gluten of the cocoon, and produces an aperture for escape. Seeing a hole by which the inmate had escaped, it was very natural to jump to this conclusion, which, after all, was so very nigh the solution that we need only read "softens" for "dissolves," and strike out the end of the sentence to explain the mode in which the *Cuspidates* emerge. The peculiar-looking larva and habit of pupation of *Cerula vinula* (the *Puss* moth) has always had a charm for writers on entomology, yet not one of the group has been so badly observed in those minute particulars the record of which materially affects the life-history of the subject; this may be perhaps partly owing to the awkward hour for observation (from 12 to 2 in the day) chosen by preference for its emergence from the pupa—awkward because the great proportion of entomologists are men occupied in commercial or other pursuits which take up the middle of the day, and preclude them from minutely following (even if so inclined) the final changes of this and similarly disposed insects. All who have reared specimens in confinement know how fond caterpillars are of forming their cocoons one upon another; this was indirectly the means of enabling me to record some

curious observations. In 1867 I bred several of these moths, and upon removing the old pupa cases from the breeding cages some short time afterwards I found a fully developed moth within a case which had duly escaped from the chrysalis, but afterwards, in consequence of the extra hardness of the outer shell caused by another caterpillar spinning up against its cocoon (as above mentioned), was unable to make its escape and had died within. This determined me to breed a large series, that I might, if possible, learn the means by which the imago released itself from the hard shelly prison in which it had previously been immured. In the following month of April, having obtained a good supply, I purposely removed many pupæ from their cases, the better to watch their progress. This proceeding was of course the death-blow to all timid or nervous specimens; the more robust, however, beyond contracting still more their hinder segments, seemed none the worse, and as time progressed, I was glad that I had done so. When the imago of a Sphinx emerges from the chrysalis the upper portion of the shell is entirely burst off by the pressure of the insect within, and the moth has no difficulty in making an immediate escape; with *Vinula* the procedure is more leisurely and more complicated. As with the *Nocturni*, I noticed the pupæ to become very restless; this continued for a period of time varying from half-an-hour to 2½ hours, the chrysalis turning over and over without seemingly any definite object. This motion was sometimes prolonged for many consecutive seconds, and was, as is usually the case after exertion in higher orders, interspersed with periods of repose. After this another movement began, viz., a bending backwards once or twice; this was succeeded by the usual abdominal elongation, and soon a longitudinal split appeared in the thorax, which continued to increase as the insect exerted its powers from within; then cross splits showed themselves near the head, gradually extending to the front and joining some which ran down by the antennæ, &c. When a space sufficiently large had shown itself the left fore-leg was drawn out, followed by the right, and after a moment's rest the imago drew itself clear of the pupa-case. The head, face, and shoulders were still covered with a portion of the case however, completely masking them, nor was this removed until after a transparent fluid had been ejected, I presume, from the mouth; after several drops of this had been exuded, the mask either fell from the face or was scratched off by the forelegs, and the moth sought a favourable place where the wings might expand and harden. Up to this time a quarter of an hour only had elapsed from the time I first distinguished the cracking of the pupa shell. The result of this experiment and observation was peculiarly gratifying to me at the time; it was not only new (for I could find nothing bearing on the matter in books), but it explained so much in itself. Like others, I had noticed the gradually increasing dampness at the end of the hard cocoon, and seen the insect break forth, but omitted the casting of the shield (in a natural state more quickly shed during emergence); now the whole proceeding was laid clear before me, and the varied statements of authors proved to have been founded on conjecture. A fluid (whether an acid or not* is of no consequence)

* In Silkworms this has been distinctly proved to be an acid.

is used by the insect whilst within; it is applied, owing to the peculiar masking of the head and face, over a larger circle than could possibly be the case otherwise within the same time, softening the gluten of the silken threads and the intermingled wooden or earthen particles interwoven for the purpose of strengthening the outer wall, which then yields readily enough to the struggling prisoner, who, in escaping, by the aid of the mask equally protects the as yet tender head from harm and stickiness of the still damp threads of the cocoon. Is not some such action set up in *Lanestris*? That interesting enigma has still to be worked out. The diminutive cocoon for the size of the moth, and the minute pin-hole opening, assumed to be for air, have attracted passing notice; but the emergence is not recorded. It is an anomaly; but has it a dipterous habit? That is what we want to know; and those residing in the London district, where the insect is pretty common, might well work out its history—not known because not looked into. Although less silk is used in their construction, some of the cocoons of the *Noctua* are scarcely less solid in their entirety than those of the *Cuspidates*. The group, from its sameness of habit, has small charms for me; and, as I am speaking of things that have come under my own observation, I cannot tell if they emerge in the same way. I am inclined to think, however, that pressure alone causes a place of exit to be made from within; for an examination of the hard cocoon of the *Sharks* or *Dianthecia* will show the smaller end to be excessively thin. It is true that I have seen none that have been opened soon after building; but were the wearing down to be attributed to friction on the part of the pupa, the latter must equally suffer with the envelope it destroys, which does not seem to be the case. The surrounding web or cocoon of the *Geometer* is, as a rule, very slight, and offers little impediment to the escaping insect; nevertheless, the pupa-case itself is as completely broken up as in any of the foregoing. Some of the species emerge below the surface of the ground, pushing through at the same time; of such *Vitalbata* and *Comitata* may be taken as examples; but the imago of these and many more insects of this habit may generally be recognised by the finer scaling on the wing-disc. When reared in confinement the pupæ should be dug up and placed on the surface if good specimens are desired. Like *Vinula*, and evidently for the same purpose, the pupa-case of *Comitata* breaks, so as to form a shield or protection to the head, thorax, and wings, whilst forcing its way through the soil. As might be expected in so large a family, great diversities in extrusion may be seen, in some species so little damage being done to the chrysalis that one has to look closely to discern which is the empty shell; in others they are much broken, and amongst the genus *Eupithecia* (*Pugs*) the front is split off in the same manner as amongst the *Sphingidæ*. There is but little to remark in the succeeding groups. The genus *Coleophora*, one of the *Tineina*, make no preparation for the final change, beyond fastening the mouth end of their case firmly to a stem or leaf, after which they turn round, and, having assumed the chrysalis stage, in due time escape through the tip of the case, which, again

closing behind, gives no clue that they have gone. One species only has a different habit, *C. Conyzæ*; this bites off the end of the case to render after emergence easier. In some of the *Tineina* the case or cocoon makers simultaneously extrude the pupa from the cocoon and the imago from its envelope; but the *Nepticula* thrusts half its pupa through the cocoon before it begins to split for the exclusion of the perfect insect. The *Elachistidæ*, suspended on the leaf by a thread, can scarcely be known to have yielded up the perfect insect excepting by the transparent pupa shell. What a contrast to *Hip. Semele*, which smashes up the case thoroughly, and scatters it in five or six fragments on the surface! The *Pterophori* pupæ, although attached by the posterior segment, jerk themselves about in a strange manner; and some of them, previous to the imago emerging, are adorned with iridescent markings, reminding one in a slight degree of the *Vanessidæ*, whilst the red shell of *Dominula* gives an appearance to the inmate very much at variance with its natural coloration.

Having now shortly touched upon the emergence of the perfect insect, and the appearances set up in the pupa prior to the last stage of life being assumed, I must say a few words on the phenomena of the wing development previous to flight. The growth and expansion of the wings from the embryo till the time when the insect rests for the necessary hardening process previous to flight is owing to the distribution of at least two distinct fluids ejected from the body of the insect through the arteries and veins, which in their turn, after having fulfilled the offices they were primarily intended for, contract, condense, and anastomose into radial bones with basal muscles for adhesion and flight. These fluids are not projected at first together, but appear to be evolved and distributed in turn; that one that produces colour or pigment has already been in use for some time previous to the insect's emerging from the pupa. It is therefore for a time suspended in its flow, whilst the other is employed for the perfection of the wing; this is the period of growth that begins a short time after a suitable resting-place has been occupied by the insect. If now disturbed, the action is suspended or withheld, and a cripple is the result; cases, too, have been recorded where the growing power has been withdrawn altogether and the conditions reversed, so that the wings diminished in size instead of increased. The differing rumpled appearance of the wings in various species during growth is caused by the position of the wing rays, which will be readily understood by referring to the diagram wing map in Wilkinson's "*British Tortrices*." Its explanation is simple. The circulation through the posterior channels is a work of some time, whilst the flow to the centre of the wing is greater than the small passages can for a time carry away; hence in many species a bursting of the conduits would take place were it not for a bag or sac situated on the disc at the spot of junction which receives the fluid and prevents such a catastrophe. Nature, whose vagaries we so much delight in, in some foreign species places a pocket-like receptacle outside also, but in British insects this is confined to one, the curious *Vinula*, in which it can be distinctly seen whilst the insect

is alive and fresh from the pupa-case. These sacs are afterwards flattened down and lost to sight. Every now and then the growth-fluid is suspended, whilst colour or strengthening power is driven forward; but just before the wings attain their full size, a sudden flush of pigment, dilute in character, is forced through the nerves and into the scales themselves, which afterwards receive the last of the strengthening fluid (used chiefly in the secondary cilia of the wings); this also gives an individuality to the scaling, and thereby possibly increases buoyancy. By this time the wings, having obtained their full development, are thrown over the back; the surplus fluid is absorbed or returned to the body, rendering the colouring less vivid; and the arteries and veins consolidate. After a little time the insect tries its wing muscles, and then again reposes for a time, often in a different position. The times of day and night for emergence vary considerably.

Sometimes an imago seems to make no progress in its development; this is quite as often due to an excess as to want of power; a gentle touch, so as to make it change its position and extrude moisture, will generally facilitate matters. Insects bred as cripples or with imperfections should never be retained for breeding purposes; for defects, whether of form or colour, whether as three-winged, notched in the cilia, or with twisted antennæ or tibia, are distinctly stated by various authors to be congenital. Varieties, too, will beget varieties, and transmit their peculiarities unchanged to their offspring, so that it would appear to be in the blood, to use a common and colloquial expression, and, this being so, the elaborate theories of variation are reduced to a simpler code, though the primary causes are still distant and but little understood. Fortunately my subject does not require me to go deeply into this matter, but I must shortly consider how far differences of atmosphere and light may tend at the time of extrusion to develop aberrations. Firstly we may take it as a fair axiom that great heat develops colour brightness among the blues, reds, or yellows. This may often be seen in insects of a second brood. The genus *Ephyra* is a good example. Next, that damp (unless this happens to be extreme) during the pupal condition does not effect the imago, excepting in the case of a sun bleach, which is most usually seen in the *Diurni*. I have made many experiments on sun-bleaching, but without, at present, arriving at any definite results. Thirdly, it has been suggested that varieties are caused by and owing to a supercharged electric atmosphere. This might be tested by allowing a number of larvae to pupate below the soil of a breeding-cage, and by means of a battery passing currents constantly through the earth about the period of emergence. Of conjecturally altered specimens by this means, Mr. Bond has *Pamphilus*, a variety of which he attributes to some such cause; and I exhibit *Janira* bred by myself this year, the first of which was hatched out and developed during a violent thunderstorm on the morning of the 26th June; the second, which is not so strongly marked, appeared on the 28th, thunder in the distance with lightning all night; but other species coming out at the same time in a normal condition, I attach little importance to the matter; but

this sufficiently shows that further investigation is necessary. With regard to light, that is direct or reflected rays, having any effect, I must express myself a sceptic, having brought up from the egg many examples subject to starvation, repletion, and ordinary diet, under plain, green, white, yellow, orange, blue (of two tints), and crimson glass covers, without any such appreciable difference in the colour of the insects as to be strictly called a variety.

Mr. H. E. Cox read a paper on "The Legs of Beetles," in which he described in detail the structure and uses of the different parts, explaining particularly the special adaptations found amongst the Dytiscidæ and Gyrinidæ to enable them to perform their movements in and on the water.

EVENING MEETING, *March 14th*, 1879. The President exhibited a large implement of chert, from the valley of the Axe, where it had been found among gravel, not chert. In connection with this, he referred to the investigations being carried on by Mr. Worthington G. Smith by the aid of the microscope into the substances that may occasionally be found by careful search in the earth in which flint implements are met with, at such a depth as to preclude the possibility of their having been deposited there during any recent disturbance of the ground. Among these he mentioned human hairs, as well as the hairs of bat, rat, mouse, and other animals, some of which have not yet been identified.

Mr. W. Gilford gave an address on the subject of "The Geology of this district, especially in reference to the question of the Water Supply." He illustrated his subject by large geological maps including the greater part of Surrey, Sussex, and Kent, and a portion of Hampshire. He gave first a general explanation of the formations occurring in these counties, commencing with the chalk and descending to the Hastings sand, of which he enumerated the various strata, comprising the Tunbridge Wells sand, Grinstead clay, Wadhurst clay, Ashdown beds (which crop out in Ashdown Forest, Sussex, and consist mostly of very poor soil), and lowest the Ashburnham beds. It was in this series that the Wealden boring was commenced in the expectation of coming to some of the primary rocks; it was continued through the Purbeck and Portland beds and the Kimmeridge clay to a depth of 2000ft. The explorers, however, failed to reach any of the old rocks, but found beds of gypsum, which have since been worked. The Hastings sands appear to dip northwards as far as Sanderstead, near Croydon, and the Weald clay about as far as Addiscombe. The lower greensand was found in the boring at Meux's Brewery in Tottenham Court Road, but was missing at Kentish Town, where the Devonian rocks were met with. These were also found underlying the lower greensand at Meux's Brewery, their age being determined by a fossil which was pronounced certainly to belong to the Devonian series. Some geologists believe that the Devonian rocks extend from under the coal measures in Belgium through to the South Wales coalfields. The recent borings at Meux's Brewery,

Crossness, and Kentish Town, seem to confirm this view; the opinion is held by some geologists that coal will be met with on the flank of this ridge.

Mr. Gilford then referred more particularly to the formations found in the immediate neighbourhood of Reigate, beginning with the middle chalk containing flints and lower chalk without them. The upper greensand which underlies the chalk and chalk marl contains more or less of silica; it is sometimes phosphatic in its nature. It consists of alternate layers of about two feet in thickness, first of a very hard stone called roofing stone, and then of hearthstone; a third layer of roofing stone, then successive layers of hearthstone, roofing stone, and firestone, the last being a very good building stone when properly laid as found in the quarry. Below this is found a soluble silica, which is used at Farnham in manure making. A narrow band of fossils is sometimes found occurring between the upper greensand and the gault, which is the formation next in order. The gault is divided into the upper, middle, and lower, and is found well developed at Folkestone. In this neighbourhood the lower greensand exhibits well the various divisions known as the Folkestone, Sandgate, and Hythe beds. The first includes the white sand and also red and other coloured sands, which here occur as the most northern outcrop of this formation; the white sand sometimes attains a thickness of 30ft., and is important as an article of commerce. The Sandgate beds are more clayey or loamy in character, comprising the Fuller's earth and other clays. In this district these beds form the crest of the ridge formed by the outcrop of the lower greensand. The Hythe beds, which here follow a line to the south of the preceding, contain a rag inferior to the Kentish rag found in these beds near Maidstone. Below these a bed of about 30 to 50ft. of brownish clay is met with, known as the Atherfield clay. This is found near Woodhatch as a clayey sand; it next becomes a sandy clay, and lower still a pure clay. Below these beds the Wealden is reached, which in addition to clay contains in some places beds of limestone, such as the Petworth marble, &c. These are capable of taking a good polish.

Mr. Gilford pointed out the advantages arising to this district from the great variety of formations which crop out within a comparatively small area; this variety contributes to beauty of scenery, to salubrity, and to fertility of the soil, for where different soils are contiguous they become more or less mixed at the surface in the course of agricultural operations, and such are often more fertile than either one separately. Another advantage experienced here is the great profusion and variety of the flora, certain plants affecting especially a chalk soil, others a sandy one, and others clay.

Mr. Gilford next referred to the water-producing powers of the strata in this neighbourhood. We have one water-bearing bed in the upper greensand, the water being upheld by the gault immediately below. In a similar manner the weald clay enables the lower greensand to retain its water, constituting it a natural reservoir.

At Redhill the lower greensand attains a thickness of from 400 to 500 feet. It possesses good filtering powers, purifying the water from organic contaminations, and is in this respect important as a source of water supply. For this purpose the formation in the eastern part of Surrey, from Dorking to Limpsfield, was considered by Mr. Gilford to be best adapted, the broader portion further west not being so readily available owing to faults, and to the protruding of the Wealden beds. He then alluded to the Caterham waterworks, which he considered to be probably too near the chalk escarpment, as the supply in the autumn is at times deficient. He recommended that the Reigate Waterworks Company should abandon their surface supply, and bore through the gault (which would effectually prevent surface contamination) into the lower greensand, whence a practically unlimited supply might be obtained.

In the discussion which followed, Dr. Bossey advocated deep wells further north than the line of outcrop of the gault, similar to that of the Caterham Company, thus tapping the water-bearing strata at their lowest level, where the most abundant supply will be found.

EVENING MEETING, *April 18th, 1879.* Mr. R. C. Baxter read a paper entitled "A Short Description of the Sub-Wealden Gypsum Company's Works," as follows:—

I had originally intended to describe the works at Mountfield only, but I have since thought that it would make the paper more interesting if I gave a section of the shaft, with some few brief remarks on the strata, and a short account of the boring.

The boring was commenced in August, 1872, by a society of gentlemen, with Professor A. C. Ramsay as chairman, and was carried to a depth of 1018 feet, when an accident happened to the rods, and it was found impossible to continue the work. A new boring was commenced in February, 1873, and continued to a depth of 1,905 feet, when another accident occurring, the work was abandoned. The cost of the two borings was over £6,000. The object of the boring was to ascertain the nature and thickness of the strata beneath the lowest series of the Wealden formation, and also to discover whether the carboniferous strata of Belgium and the Boulonnais district of France extended across the Channel in this direction. The great thickness of the Kimmeridge clay prevented this latter question being solved.

On looking to the section you will notice some 20 feet of yellow clay, followed by bands of calcareous shales and impure limestone, which extend to a depth of some 125 feet. From this to a depth of 165 feet we have beds of gypsum and gypseous shales and limestone. Below these beds we have beds of sandstone of different qualities, extending to a depth of some 255 feet, below which I do not intend describing. The gypsum is contained between regular beds of shales and limestones, which are themselves also veined with thin layers of gypsum. The body of the gypsum, however, has no stratification, but is twisted and contorted in every conceivable way, and varies in quantity and colour every few yards. The bulk is of a dark

grey, but waves of pure gypsum or alabaster are constantly met with. Bands of a clear fibrous character, from four to six inches thick, are also met with, following the general run of the strata, which is slightly inclined to the horizon. Another variety abounds in large crystals of a pale yellow, and has received the name of sugar-candy gypsum. The hard grey takes a polish like marble, but owing to the existence of thin veins of shale it is impossible to get a uniform lustre; the same cause necessitates a very careful picking of the gypsum after baking, to prevent a dark tinge being given to the plaster.

Mr. Baxter then gave a description of the composition and nature of gypsum, and of the various conditions in which it is met with, and continued as follows:—

I will now give a description of the Sub-Wealden Company's works. They are situated at Mountfield, Sussex, some three miles from Battle Station on the Hastings line of the South Eastern Railway. They were commenced under great difficulties, as the materials and machinery for sinking the shaft had to be carted over a hilly country, and in part over field roads and through plantations, the cost of carriage being in winter as high as £1 per ton. It was soon apparent that a good road must be made to the works, and at last a railway connecting them with the South Eastern Railway, about a mile and a half distant, was decided on. This has been carried out, and is now in full operation. The processes of converting gypsum into plaster of Paris are three in number, viz., the quarrying, raising, and sorting; the baking of the stone; and lastly, the grinding and sacking. The beds of gypsum are fortunately from six to seven feet high. In these seams headings are driven about six or seven feet wide, in which are laid tramways as the work proceeds. The gypsum is drilled in different directions to a depth of three or four feet, and in the holes blasting cartridges are inserted with time fuses attached, so as to enable the miners to retire to a safe distance and await the explosion. After blasting, the stone is placed in small trucks or trollies on the tram-road, and shunted to the mouth of the pit into a cage, whence the trolley and material are raised by steam power to a height of some 30 feet above ground level. Here, by means of a timber staging and tram-road, it is discharged on to the high-level sorting platforms. On the platforms the stone is passed through powerful stone breakers driven by steam power, and then sorted. The good stone is wheeled in barrows to the kilns and then baked for some twenty-four hours. The waste is again passed through the stone breakers to further reduce it, and sold for road metal, or the portions containing rough gypsum are ground for manure. The operation of baking the plaster, though apparently a simple process, is one requiring much care and attention. As I have already stated, there are 20·79 parts of water in gypsum; now, about 20 per cent. must be driven off, but a small percentage, which we may term the water of crystallisation, has to be retained. If the whole of the water is drawn off, the plaster will not set, and becomes what is termed "dead;"

if, on the other hand, the plaster is under-baked, it sets too quickly, and then becomes soft. Plaster readily absorbs damp, and requires to be kept in a dry place. Broken plaster casts, &c., if subjected to heat to drive off the water, may be again converted into plaster of Paris, and used afresh, but it does not set so hard as fresh plaster. This process may be repeated two or three times, but on each occasion it loses much of its vitality. Good plaster should give out a sensible heat in setting. After baking, the stone is extracted from the bottom of the kilns, repeatedly tested, and then wheeled to the mill-house. At the mill the baked gypsum is passed through a second set of crushers, and descends to the stones, and after being ground the plaster is elevated to a sieve-floor, where it passes through rotating boxes formed with fine wire panels. It has now become plaster of Paris, and is conducted down deal boxes or pipes to the ground-floor; here it falls into sacks attached to the pipes, and is then weighed into quantities of 2 cwt., and wheeled into the railway trucks in a covered siding running along one side of the mill-house. I have briefly described the process of winning the gypsum and its manufacture, and have now only to glance at the purposes to which it is applied. The bulk of the plaster sold is used for cornices and enrichments of ceilings, and for plastering walls or partitions where time is an object, owing to its rapid setting qualities. The finer kinds are used for statues, busts, &c., and I regret to say, as has been shown by our police trials, for adulteration of flour; but we must hope this is an exceptional case. The material in this instance came from Antwerp. Plaster, when burnt so as to lose its setting property, is used to thicken and whiten paper, &c., also as a dressing for calicoes. From its expansion in setting, plaster is a very valuable material for making moulds to reproduce medals and coins, as it gives a very sharp cast. Coiners are well aware of this fact, and use it for their moulds. Ground unbaked gypsum is a valuable manure from its great affinity for ammonia; a thin layer of the raw powder laid on stable or other manure entirely fixes the ammonia. The lime, too, acts as a manure in most soils. Liebig speaks very favourably of it as a manure, especially for clover, beans, peas, and other leguminous plants. At Betchworth one half of a field was dressed with gypsum, and the straw was 50 per cent. in excess of the other half where none was used, and the ears were much larger. A vast number of articles more or less ornamental are made from the Derbyshire gypsum, as vases, candlesticks, boxes, watch-stands, paper-weights, &c. A large export trade is done with America in these articles. The excellent qualities of Bass's and Allsopp's ales are stated to be partly due to the water, which is derived from a gypseous stratum. Broken or pounded gypsum is used by some brewers to harden the liquor. The large amount of sulphuric acid (46·31) present in gypsum has suggested the manufacture of that acid from gypsum, but although several attempts have been made to extract the acid, it has, I believe, up to the present time not been done so as to be a financial success. Pure gypsum or alabaster has been much used for tombs and monuments in our cathedrals and churches, particularly during the reigns of

Elizabeth and James. There are many fine examples in Westminster Abbey, and I believe there is one in our parish church of Reigate. The gypsum, from the red tint in the veins, evidently came from the marls of Lincoln or Nottingham, in fact must have come from that district, as it was unknown in the south of England till discovered by the Sub-Wealden boring. How such ponderous blocks, weighing many tons, were transported such long distances, with scarcely any hard roads, is a difficult problem to solve. Many of these tombs were highly coloured and gilt. At the present time gypsum is largely used in church decoration, and some magnificent works of art now adorn our cathedrals in the shape of pulpits, screens, reredoses, and monuments that could hardly have been excelled in the best periods of Gothic art.

The President (Mr. Sydney Webb) read a paper entitled "A Visit to Romney Marsh," to which were appended lists of the Lepidoptera and of the plants met with during his visit.

ANNUAL GENERAL MEETING, *October 10th*, 1879. The Annual Report and statement of accounts, duly audited, were read and adopted, as follows:—

ANNUAL REPORT.

Since the date of the last Annual Report five new members have been admitted into the Club; and eight have left it by resignation or removal, and one by death.

Winter Evening Meetings. These were held regularly each month from October to April, and the attendance and interest were well maintained. The subjects introduced were as usual very varied. The papers read were as follows:

"The Yew-tree," by Mr. Tyndall, November 8th.

"Relations subsisting between Water and Growing Plants," by Dr. Bossey, January 10th.

"Notes on Ornithology for the past year," by the Secretary, Mr. J. B. Crosfield, January 10th.

"Phenomena connected with the Emergence of Lepidoptera from the Chrysalis," by the President, Mr. Sydney Webb, February 11th.

"The Legs of Beetles," by Mr. H. E. Cox, February 14th

An address on "The Geology of the District, especially in reference to the question of the Water Supply," by Mr. W. Gilford, March 14th.

"A short description of the Sub-Wealden Gypsum Company's Works," by Mr. R. C. Baxter, April 18th.

"A Visit to Romney Marsh," by the President, April 18th.

Lecture. The Club is again indebted to Mr. Henry Seebohm for a lecture, which was delivered in the Public Hall on December 13th, the subject being "Six Months in Siberia." The lecturer gave an account of his journey in the year 1877, during which he devoted his attention principally to ornithology. He obtained specimens of the following eggs never previously taken, viz.—*Phylloscopus borealis* (Blas.), *Ph. tristis* (Blyth), *Charadrius fulvus* (Gm.), and *Turdus obscurus* (Gm.); as well as of several others only obtained once or twice previously.

Meteorology. Mr. Tyndall furnished tables of the Barometric pressure, Temperature, and Rainfall for the years 1877 and 1878; also occasional meteorological notes. The total rainfall recorded at Redhill for 1877 was 39.07 inches, and for 1878 31.71 inches. In June, 1878, the maximum temperature exceeded 80° on six consecutive days, viz., the 23rd to the 28th inclusive; and in July it exceeded 80° also on six consecutive days, viz., the 17th to the 22nd inclusive; it did not attain to 80° on any other day in 1878.

New Species. The following species new to the district have been recorded:—

Lepidoptera. *Eremobia ochroleuca*, *Cheimatobia boreata*, *Coleophora albicans* (larva previously exhibited), *Eupithecia debiliata* (bred from larva taken at Leith Hill), *Phyllocnistis salignella*, *Bucculatrix Demaryella*, *Gelechia distinctella*, *G. celerella*, *G. instabilella*, *G. nigritlella*, *Phycis Betulæ*, *Pterophora teucarii*; all exhibited and recorded by the President, October 11th, 1878.

Botany. Dr. Bossey recorded *Silene italica*, found two or three years ago by the side of the new road leading from Shaw's Corner to Mr. Pym's farm. A specimen of *Daphne Laureola* was exhibited by Mr. S. E. Field, on March 14th, which was gathered on Reigate Hill, near the Suspension Bridge. This is a new locality, although the plant occurs elsewhere in our district.

Prizes. The prizes for collections were awarded as follows:—Botany:—First prize, Miss Eliza Wilson, Reigate; second, Mr. E. P. Collett, Reigate; third, Miss Rosa Marriage, Meadvale. Entomology:—First prize, Mr. Edwin Ashby, Redhill. Geology:—Third prize, Mr. Edwin Ashby. The Committee have made offers of prizes this year for collections of Botany, Entomology, and Conchology on similar conditions to those of last year.

Excursions. Five whole day and four afternoon excursions were projected for the past summer, viz:—

WHOLE DAY.		AFTERNOON.	
May 24.	St. Leonard's Forest.	May 10.	Rice Bridge and Wonham.
June 28.	Ockley and Leith Hill.	June 14.	Reigate Heath, &c.
July 26.	Caterham Junction and Downs eastward.	July 12.	Merstham and Hills to eastward.
Aug. 23.	Edenbridge.	Aug. 9.	Kingswood and Walton Heath.
Sept. 20.	Addington Hills.		

Those to Edenbridge, Leith Hill, and Kingswood unfortunately fell through owing to unfavourable weather or other causes.

June 14. Reigate Heath, &c. *Ophioglossum vulgatum* was found in an orchard near Buckland.

July 12. Merstham. *Astragalus glycyphyllus* and *Galium tricornis* were met with in flower. A Cirl Bunting was observed singing.

July 26. Caterham Junction. In the chalk pit traces of *Dercetis elongatus* (a Gar-like fish) were observed; also *Spatangi* with *Crania parisiensis* upon them, and a few bones of star-fishes. A perfectly albino variety of the common red poppy (*Papaver Rhæas*) was gathered.

Sept. 20. Addington. Between the Addington Hills and Crohamhurst the larva of *Elachista teniella* was found mining in the leaves of

Brachypodium sylvaticum. It had already been recorded from Wray Lane, but this occurrence gives a second southern locality for this Darlington species. A Green Woodpecker was heard and seen in Addington Park. A great variety of Fungi was observed, including the following species:—*Agaricus phalloides*, *A. muscarius*, and *A. rubescens*, belonging to the sub-genus *Amanita*; *A. æruginosus*, *A. laccatus*, *Lactarius deliciosus*, *L. quietus*, *Hygrophorus conicus*, *Cantharellus cibarius*, *Boletus scaber*, *Craterellus sinuosus*, &c. The Addington Hills consist principally of very round flint gravel, for the most part nearly uniform in size, and intermixed with comparatively little sand or clay. This belongs to the formation known as the Oldhaven sands, and is here remarkably well displayed. A gravel pit in Addington Park presented a perpendicular section of some 15 feet, along the face of which were traceable at intervals of every few feet layers of rather smaller sized and less tightly packed gravel, seeming to indicate the course of a stream at some former period. It was also interesting to note here and there the dark staining of some of the gravel, as if from the presence of organic matter. The angular character of the gravel now known as the Wandle gravel in the pits of the Brighton Railway Company at Central Croydon Station presented a striking contrast to that of the Addington Hills.

Donations.—The thanks of the Club are due to Mr. Tyndall for six volumes of "Symons's British Rainfall" for the years 1872 to 1877 inclusive, and to Mr J. Linnell, jun., for "Bentham's Illustrated Handbook of British Flora" in two volumes.

The Committee cannot close their report without referring with feelings of sincere regret to the death of William Wilson Saunders, Esq., F.R.S., the founder, and for many years the valued and esteemed President of this Club, to whose constant devotion to its welfare and advancement a large measure of the Club's success is due. His death occurred at Raystead, Worthing, on the 13th of September.

ABSTRACT OF BALANCE-SHEET.

RECEIPTS.				EXPENDITURE.			
	£	s.	d.		£	s.	d.
Oct. 1878. Balance in hand	15	3	4	1878-1879. Rent of Museum			
1879. Subscriptions received ...	23	17	0	and Gas ...	16	3	2
				Expenses, Assistant			
				Curator ...	5	12	6
				Attendance and cleaning ...	1	2	0
				Zoologist ...	0	13	0
				Spirits of Wine, &c. ...	0	4	8
				Collector's Commission,			
				Printing, and Postage ...	2	0	11
				Oct. 1, 1879. Balance in hand...	13	4	1
	£39	0	4		£39	0	4

The following gentlemen were elected as the officers of the Club for the ensuing year:—President, Mr. S. Webb; Treasurer, Mr. R. C. Baxter; Secretary, Mr. J. B. Crosfield; Curator, Mr. J. Linnell, junr.; Committee, Dr. Bossey, Mr. Tyndall, Dr. Holman, Mr. Chambers, Mr. T. Cooper, Mr. Marshall, Mr. A. J. Crosfield, Mr. Gilford, and Mr. A. Bennett.

A resolution was unanimously adopted expressive of the great regret of the Club at the death of William Wilson Saunders, Esq., F.R.S., the founder of the Club in 1857, and from that time until his removal from Reigate in 1874, its President. The Secretary was directed to forward a copy of the resolution to Mrs. Saunders.

The President exhibited five Noctuas, *Nonagria sparganii*, which were bred by himself, being the first instance recorded in this country. He exhibited also a Camberwell Beauty (*Vanessa Antiopa*) caught in the neighbourhood two years ago, also three dark specimens of the Painted Lady (*Cynthia Cardui*). He referred to the extraordinary abundance of this insect during the present season, and expressed his doubts whether the large numbers had come over from abroad, as supposed by some, mentioning that the species was met with in abundance as early as June 14 on the occasion of the excursion of the Club to Reigate Heath and Betchworth. He also exhibited specimens of *Cidaria russata* bred from Tilgate Forest, and others from Somerset and Devon.

EVENING MEETING, *November 14th*, 1879. Mr. Edward Bidwell of London brought for exhibition his valuable collection of young birds in the down, comprising the following species:—

Raptores: Goshawk, Black Kite, Tawny Owl.

Rasores: Red Grouse, Quail.

Grallatores: Peewit, Avocet, Redshank, Wood Sandpiper, Common Sandpiper, Green Sandpiper, Ruff, Dunlin, Woodcock, Snipe, Spoonbill, Heron, Little Egret, Land Rail, Spotted Crake, Moorhen, Coot.

Natatores: Mute Swan, Wild Duck, Red-breasted Merganser, Red-throated Diver, Little Grebe, Puffin, Black Guillemot, Gannet, Common Tern, Arctic Tern, Lesser Tern, White-winged Black Tern, Kittiwake, Black-headed Gull, Lesser Black-backed Gull, Great Black-backed Gull, Great Black-headed Gull, Herring Gull, Richardson's Skua, Manx Shearwater, Stormy Petrel.

Mr. Bidwell read a short paper on the subject of young birds in the down:—

For some three or four years I have collected specimens of the young of such of our British birds as are covered with down when hatched, but up to the present I have had no opportunity of studying them, and in fact have been nothing more than a mere collector. Of this particular stage of bird life nothing has been written in English, and many of our ornithological writers do not refer to the birds in this condition, while a few of the more recent authors content themselves with a short description, such as, "The young when hatched are covered with a parti-coloured down, but they fledge very rapidly," or some equally interesting remark of the same character.

Our birds are divided into five orders. Of these the first are the *l'apteres*,

all of which are hatched with a covering of down. The *Insectores* are all naked or squab young, with the single exception of the *Caprimulgidæ*. The *Columbidæ* are the only exception to the *Rasores*, whilst all the *Grallatores* are downy. Of the remaining order, the *Natatores*, the *Pelicanidæ* form the only exception, and they, though hatched naked, are in two or three days much more presentable. With a few exceptions the young of all the species of which we are speaking of the last three orders can run or swim as soon as they leave the egg, the most notable exceptions being the *Ardeidæ*, *Alcidæ*, *Pelicanidæ*, and *Procellariidæ*. The markings of the young birds of the orders *Rasores*, *Grallatores*, and *Natatores* are remarkably arranged to afford protection. As an instance of this I may mention the case of the two young ringed plovers (exhibited). One day in the early part of August, 1875, I was shooting with a friend on the Essex coast, when I saw a ringed plover settle near the water's edge at some distance from me. As I had only a small walking-stick gun, I wanted to get considerably nearer, and so went round to the back of a bank of Marham grass, and after crawling on my hands and knees for some distance, I reached within about 35 yards of the spot where I had marked the bird down. On peeping through the grass no plover was to be seen, but I could see quite a small bird, which I thought might be a little stint running at the edge of the waves. On firing I could not see any bird fly away, and so concluded I had obtained my specimen. On walking up to the spot I could not find it, and my friend joined me in the search. The sand was scored with the shot marks as though it had been raked, but not a feather was to be seen. After looking about for 20 minutes, we were just on the point of giving up the search in disgust, when I remarked, "What a curious bit of seaweed that is," pointing to a small lump on the sand; and directly afterwards saw that it was a young plover squatting down with its beak resting on the sand. We must have passed it many times, as the sand around was quite trodden down by us, and it was a wonder it had not been stamped on. I at once secured it for my collection. On passing the spot half an hour later we noticed another young bird, and at once walked down to get it, but although we knew what to look for, it was some time before we could distinguish it from the seaweed and stones which it so closely resembled. When at the mouth of the Petchora in 1875, Messrs. Seebohm and Harvie-Brown found on the tundra a nest with the empty eggshells of the grey plover, and though they, assisted by their two collectors, searched for some time, they were unable to find the young birds, although from the behaviour of the parents they were certain the chicks were in their immediate vicinity. The next day they found a young bird by accident, which they describe as being very yellow, speckled with black, and admirably adapted for concealment upon the yellowish-green moss on the edge of the little bogs, close to which the grey plover seems always to choose a place for its nest.

As an instance of the activity of some of these young birds I may mention the following told me by Mr. Bond. He one day found a nest of the little grebe in a small pond about three yards in diameter, and rather shallow.

He visited the spot every day, until one morning he found the bird had hatched off; so in the afternoon he went down with three companions, two of them armed with butterfly-nets, but it took them some hours to catch four of the young birds. Of the *Natatores* which I mentioned as being hatched without down, the following particulars may be interesting. The young cormorants when first hatched are quite naked, the skin being of a purplish black. This in six or seven days becomes clothed with a thick black down, but the feathered plumage is not perfected in less than five or six weeks. The young gannets when hatched are naked, their skin smooth and bluish black, but covered in a few days with a white down, which, growing very rapidly, soon becomes very thick, giving them in this state the appearance of large powder puffs or masses of cotton.

In the discussion which followed the reading of the paper, Mr. H. M. Wallis mentioned having on one occasion come upon a brood of young greenshanks, and spoke of the great similarity of the colour of their down to the mottled appearance of the surrounding lichen and moss found in the locality, so that they were very easily overlooked or lost sight of. He contrasted this with the slaty colour and perfectly naked condition of the young rook, a bird which does not require any such special protection. In reference to Mr. Bidwell's statement that the young birds in the family Caprimulgidae are clothed with down, Mr. Wallis stated that he could confirm this, having once found a young nightjar recently hatched at Crohamhurst, near Croydon. He observed that this young bird possessed the faculty of running—a power which is lost in the adult bird. The legs were proportionately much longer in the young than in the adult. Dr. Bossey enquired whether it might be laid down that the colouring of the down on young birds is correlated to that of the surrounding ground or other objects. Mr. Bidwell, in reply, said that this certainly appears to be the case in many instances; and in confirmation of the remarks on this subject in his paper as illustrated by the instance quoted of the grey plover, he exhibited the coloured plate of the young bird of this species, in Dresser's "Birds of Europe." Mr. S. Webb remarked that, generally speaking in nature, things are found to be specially coloured where required for purposes of protection or other causes. Mr. A. J. Crosfield, referring to the specimen of the young little grebe, thought this might perhaps be an instance of protective colouring, as the dark back might serve to protect it from enemies above, and the white breast and under parts might equally protect it from enemies below the water.

Mr. A. J. Crosfield then read a paper on the subject of "Man's Influence on the Flora of the neighbourhood," as follows:—

Certain species both in the animal and vegetable kingdom appear specially to thrive under the influence of man, whilst on the other hand the presence of man seems by slow degrees to become fatal to some species. Amongst mammals, rats and mice may be almost regarded as human parasites. It is well-known that the range of the house sparrow is limited by the range of man, or perhaps

more accurately by the cultivation of corn. So amongst plants, we find the groundsel, chickweed, shepherd's purse, *Veronica agrestis*, *V. hederifolia*, *V. Buxbaumii*, *Euphorbia Peplus*, and others which may be almost regarded as domestic plants. Where man has broken up the soil in gardens or fields, these and other weeds at once establish themselves. Where man utterly neglects the soil these weeds may linger, but their abundant growth and rapid spread is quickly checked by a set of perennial plants, whose more vigorous roots by degrees obtain the monopoly of the soil. Thus the growth of population very seriously affects the flora of the neighbourhood. It is impossible to prove in the case of most plants whether they are on the increase or on the decrease. The number of individual specimens, in the case of annuals at least, will vary vastly according to the dryness or wetness, the cold or the heat of the season. That certain weeds are spreading is evident. *Veronica Buxbaumii* has established itself during the present century, and may now be collected by the cartload on a single estate. Brewer, writing in 1856, says :—"I shall not soon forget the pleasure I experienced in finding a plant of *V. Buxbaumii* in my garden ; I did not allow it to be disturbed, and it is now one of the commonest weeds there." *Erigeron canadensis* is unmentioned in Brewer's "*Flora of Reigate*," published in 1856. It is now well established on the light sandy soils, especially in the fields between Reigate and Redhill. We strongly suspect, but cannot prove, that *Spergula arvensis*, *Papaver Rhaas*, *P. dubium* and *P. Argemone*, *Senebiera Coronopus*, *Euphorbia Peplus*, *Anagallis arvensis*, *Lamium incisum*, *L. amplexicaule*, *Medicago lupulina*, *Linaria spuria*, *L. elatine*, and *Alchemilla arvensis* are on the increase around Reigate. Drainage and cultivation appear to favour the spread of these. On the other hand a heavyish percentage of the plants which figure in the *Flora* are clearly doomed to extermination, as far as our own neighbourhood is concerned. The laying out of roads, and turning of roads into streets, is gradually driving many most interesting flowers further from Reigate. Most of us can remember the time when *Sedum Telephium* might be gathered on the left hand side of the Grammar School hill, and *Asplenium Adiantum-nigrum* on the right hand side. Both are now gone. A few plants of *A. Adiantum-nigrum* may yet be gathered in the sandy laues beyond Reigate Heath, but the rage for transplanting ferns into gardens is every year thinning the number of wild ones. *Scolopendrium vulgare*, never abundant, has long since been rooted out of the lane leading from Linkfield-street to Wray Common, and has probably by this time finally vanished from "lanes on the south side of Park Hill." The Adder's Tongue (*Ophioglossum vulgatum*) is reported as growing on both sides of the Wray Park Road. The sides of Wray Park Road have been too long systematically cleared of weeds to leave any hopes of the Adder's Tongue being again seen there. About twenty square yards of ground on Reigate Heath are the only spot in our district where we know that it survives. Should a day ever come for the enclosing or laying out of Reigate Heath, the death warrant will have been signed for six or seven

species which now linger there. The existence of that most delicate of flowers, *Campanula hederacea*, is already most precarious. This year probably not more than a dozen flowers of it bloomed. A few bushes which formerly sheltered it have been cut down, exposing it to double danger. Should it be driven from Reigate Heath we shall not find it nearer than Tilgate Forest. The same may perhaps be said of *Anagallis tenella*; and we do not certainly know that *Viola palustris*, *Drosera rotundifolia*, *Hypericum elodes*, *Menyanthes trifoliata*, and *Blechnum boreale* grow between Reigate Heath and the Holmwood. *Osmunda regalis* and *Comarum palustre* are said once to have grown in the bogs near Reigate Heath. No plant of either species has, we believe, been seen there for many years. The clearing out of hedge bottoms clears away such plants as *Lathyrus Nissolia*, *Allium ursinum*, &c. Neither of these is gone yet, but both are likely to go. In 1877 a few plants of *L. Nissolia* appeared to have a good chance of surviving on the edge of a copse on Colley Farm. In 1878 the owner of the ground brought cultivation forward a few yards, and destroyed every remnant of the *Lathyrus*. In the London Road locality the *Lathyrus* is yearly cut down when the roadside grass is cut, so that few pods ever ripen now. We believe it is still abundant around Outwood. Within the writer's memory *Allium ursinum* flourished in the wood opposite the end of Brightlands Road. The wood is gone, and *Allium ursinum* must now be sought for in copses on Reigate Hill, and in a few hedge-bottoms below the Hill. Within the last fortnight the sides of the Croydon Road have been cleared of weeds. This means the destruction of many plants of strawberry-headed Trefoil (*Trifolium fragiferum*). Within the last five years many Bee and Man Orchises must have been destroyed through the rough land below Wray Lane having been broken up and utilised. The spread of these species is at the best so slow that we can ill afford any wholesale destruction of them. *Ophrys apifera* var. *Trollii* has been found sparingly in past years on the slopes below the chalkpit on Reigate Hill. This year (1879) sheep were fed over the bank in question, giving no chance to the orchises of coming to perfection. *Lathyrus sylvestris* held its own till very recently on the left hand bank of Wray Lane. The railway cutting at Merstham is now one of its strongholds; and it grows in profusion along the hillside eastward from Merstham. *Geranium pyrenaicum* flourishes on the banks of the Merstham cutting. In this case the work of man has been favourable to the life of the plant. The tenacity with which some species cling to life in spite of man's ill-usage is surprising. *Salvia verbenaca* may yet be found amongst the well-trimmed turf in the Castle Grounds. *Saponaria officinalis*, though a showy plant, still grows on the banks of the sandy lane at South Park. Its flowers must be constantly gathered, but its roots still retain their hold upon the soil. Within the last five years, at any rate, *Colchicum autumnale* has flowered in the field adjoining Wray Common. The number of individual specimens of these species is so small that their presence and survival suggest the question, were they once much more common than now? Or have chance causes brought a single living seed or plant to the

neighbourhood, and has the struggle to gain a footing been in a measure successful? The former idea agrees better with present appearances.

In the conversation which followed the reading of the paper, Dr. Bossey remarked that each particular kind of cultivation seems to possess its own special kind of weeds. Thus *Galium tricornis* and many other species are associated with the cultivation of corn. He further spoke of the importance to be attached to the introduction of new plants from abroad by their seed getting mixed with foreign seed imported into this country. By this agency many species have been introduced from Germany and other countries. Mr. H. M. Wallis said that he had found dock seed mixed amongst seed from America. He believed that the Dock had originally found its way to America amongst English clover, which is now cultivated there; so that we are now introducing dock seed produced from seed grown here. Mr. J. Linnell, jun., referring to the locality named in the paper for *Ophioglossum vulgatum*, said that it had been found in abundance in a meadow at Reigate Hill during the past summer. He also mentioned that *Orchis ustulata* had been met with during the summer on Reigate Hill, a new locality; and that the snowdrop and tulip had each been found still growing in the localities named in the "Flora of Reigate." Mr. J. B. Crosfield remarked that although man's operations generally tended towards the extermination of plants, yet in some cases they had the opposite effect. Thus, when the ground is disturbed in a place where it has been untouched for a considerable time, it often happens that a crop of plants springs up apparently unconnected with the locality; and so when a railway is made, many seeds which may have long lain dormant are often brought to the surface by man's agency, and so have the opportunity of germinating. He also referred to the great profusion with which many flowers frequently grow on the sides of a railway embankment or cutting, mentioning several species that are met with by the line between Reigate and London. Mr. A. Bennett, in reply to a question as to the occurrence of *Teucrium Botrys* near Croydon, mentioned that it was first recorded by Mr. Bower in 1855. It was again met with in more abundance five years ago, growing in some stony fields in a soil somewhat similar to that in which it is found at Box Hill. Mr. Bennett stated in reference to *Lepidium Draba*, a plant that had been alluded to during the conversation, that it was well authenticated that this species had been introduced and established in this country on the return of the British troops from the Walcheren expedition in 1809. The beds used by the soldiers were turned out near Margate, and were ultimately spread out on the land as a manure, and it was by means of them that the seed got diffused.

EVENING MEETING, December 12th, 1879.—Dr. Bossey read a paper entitled "Thames Mud in relation to Sanitary Science," as follows:—

The mud of the Thames consists of such substances as are first floated into the river, and then deposited from it—of such organisms, animal and vegetable, as are developed in and upon the matters so deposited, and of such chemical substances as result from decompositions and recombinations

in the mud itself. The composition of this mud will vary in different parts of the river. In its upper reaches, where the stream flows through an agricultural district, the deposit will consist of sand, clay, and the debris of growing crops and decaying leaves and manure, with some of the contents of ponds, ditches, and streams by which these other matters are conveyed to the river. In the thickly peopled districts, as from London to Woolwich, and at the outfalls of the London sewers, there will be added to the former deposit the contents of house-drains and sewers, the rubbish of dust-bins, and the refuse of factories, with road grit and gutter mud. Still lower down, as we approach the estuary of the river, the flood tide will bring in its contribution, sand and mud from the sea, with seaweed and other organisms, and the ebb tide will make a still larger addition of mud and other matters washed out from the saltings which border the estuary and lower reaches of the river. The different matters from these and other sources thus brought into the river are subjected to a variety of influences, and undergo a variety of changes. Salt water and fresh water, and organic bodies belonging to each of them, with every variety of town refuse, are all more or less mixed together, and in this mixed state are subjected to a variety of movements produced by the flux and efflux of the tide, the disturbance produced by winds, and by the traffic of steam and other vessels on the river.

With such a variety of elements at work, it is little to be wondered that there should be great difference of opinion on many points connected with the physical history of the river. On one of these points, as you are doubtless aware, the Conservators of the Thames and the Metropolitan Board of Works have for some time past kept up an earnest, not to say acrimonious contest, the Conservators having asserted that mud banks are forming in the river, and that these mud banks owe their origin to the discharge of matters from the outlets of the London sewers at Barking Creek and Crossness. One of the mud banks in dispute is opposite St. Thomas's Hospital, and of course if it can be proved that this and similar banks are formed in the way the Thames Conservators believe they are, it follows that London is still on the banks of a river largely contaminated with sewage, and that the great expense incurred in removing the outlet of its sewers to Crossness and Barking will be of little avail in a sanitary point of view. It becomes, then, a matter of great importance to determine whether the flood tide has the power of transporting matters from the lower to the higher reaches of the river, and also whether we have any means by which we can determine whence the matter composing any particular mud bank has been derived. On both these points I have thought that an investigation of the animal and vegetable organisms found as a constituent part of the mud at any particular locality might afford useful if not decisive information. With a view of testing this principle I have obtained mud from different parts of the river, commencing half a mile above Teddington Lock, and ending with the estuary or mouth of the river at Sheerness. From every one of the samples I have collected as many Diatoms as I possibly could, and tabulated the result. I have selected the Diatomaceæ as a

test, because I am better acquainted with them than I am with the other minute organisms found in Thames mud, and because, to use the words of Mr. O'Meara, "some species are found only in fresh water, some only in salt, and an experienced observer will be able at a glance to ascertain whether a gathering is marine or made in fresh or brackish water." Tested in this way, I find that mud taken half a mile above Teddington Lock contained 66 species of fresh water and no marine Diatoms. Another sample of mud, one mile below Teddington Lock, had 54 fresh water and no marine forms. A sample taken at Kew, five miles below Teddington Lock, had 52 fresh water and 37 marine forms. Another taken at Blackwall had 39 fresh water and 45 marine forms. In the face of such facts, I think it will be no presumption on my part to say that the study of the natural history of the Thames mud affords important evidence in the support of the position taken by the Conservators of the Thames, and I may add that the possibility of the facts of natural history being thus applied in such an unpromising field is only additional proof that all knowledge is useful, when occasion offers for its application.

The following table presents the respective numbers of fresh water and marine Diatoms found in the mud from the various localities:—

	Half a mile above Teddington Lock.	Teddington Cut.	One mile below Teddington Lock.	Between Richmond and Twickenham.	Kew.	Blackwall.	Estuary of Thames.
Fresh water diatoms	66	35	54	48	52	39	9
Salt water diatoms	0	0	0	17	37	45	60

Mr. Tyndall read a paper on the subject of "The Extent of the Prospect from Reigate Hill," as follows:—Most of us, perhaps all, have often surveyed the beautiful, extensive, and varied prospect from Reigate Hill without regard to the *extent* of the prospect under view. It would be very interesting to have an account of the various places of interest to be seen from that elevation; but an account of all these, and of the geological formations within view, would require a volume, and not a paper merely, and would take hours to peruse instead of minutes. The object of this paper is to indicate the *extent* of prospect within view; and this limited subject may be new to some, while I trust it may be of interest to all. By Reigate Hill I do not mean one standpoint only, but the line of hill, taking it from the Suspension Bridge, through the beeches, to the knoll at the west end of the hill, over the old road to Walton Heath. Commencing our walk from the Suspension Bridge, along the lane westward towards the grove of

beeches, we notice that the field on the right or north side of the lane is some few feet higher than the lane. We forthwith commit trespass, get through the hedge, climb the bank, and look north. The whole paper now read supposes a clear day. A N.W. wind is about the best, but for some points of view a N.E. is desirable. Looking nearly due N. we shall see Harrow and its church, a place famous for its school, and for having educated some of our most able men in all branches of public service. A little to the east is the high ground about Stanmore, about 500ft., the highest land in Middlesex. Taking the course of the sun, *i.e.*, proceeding east, which is the plan I propose to pursue, we come a few miles nearer home to Hampstead and its famous Heath, with a church of slender spire. Next in order is Highgate, with its church on the crown of the hill, overlooking the cemetery which lies below it. In former times, a very fine view of London and of the country beyond was obtained from Highgate; the view being diversified and beautified by glimpses of the river Thames and of vessels upon it. I have often had this beautiful prospect in olden time, on a summer evening, with an easterly wind blowing. Now, I am afraid, smoke almost constantly obscures the prospect. A little further east and a little further back come the line of Muswell Hill, and in the distance the high ground near Enfield Chase. Portions of the old forest still remain in the neighbourhood as enclosed and private woods. We now pass over the valley of the river Lea, and arrive at the high ground in Epping Forest, of which the highest point is High Beech, about 12 miles from London. From this point (about 750ft.) was formerly a fine woodland prospect, also a prospect of the valley of the Lea, the Thames, and the chalk hills of Surrey and Kent. Still a little more east, we have, nearer home, Shooter's Hill, with its tower, from which also is a fine prospect. In the far distance, looking like a cloud, in Essex, are the Langdon Hills (about 800ft.). From these hills is obtained one of the finest prospects in the south of England. They lie about due north of Gravesend, and about 8 to 10 miles from it. They embrace a prospect of fertile, well wooded land in Essex, looking to the W. and N.; and looking to the S. and E. may be traced the river Thames from Woolwich to the Nore, with the opposite hills in Kent and Surrey. On the north side of the Thames, so far as we have gone, the view from Reigate Hill to Stanmore is about 30 miles, to Hampstead and Highgate about 25, to High Beech over 30, and to Langdon Hills not much short of 40 miles. Quitting our view of the N. side of the Thames, and coming nearer home, we notice the range of the North Downs, trending to the N.E., of which range Reigate Hill is part. These North Downs form the hills about Caterham, and shut out the view in that direction. Leaving the field where we had committed trespass, we now descend into the lane, and pursue our way towards the beeches. Just at the end of the lane, before entering the grove, turning sharp round to the left, is a gate into a field, from which may be had a very delightful view to the east; but as we shall have this view more fully, having passed through the whole length of the grove, we do not stay at the gate. Arrived, therefore, through the

grove, we turn to the left to a knoll bare of trees, and covered with long grass, with here and there a furze bush. Here we get the most extensive prospect. Turning east we see Toys Hill, the highest point in that direction of the greensand. This lower greensand range runs parallel to the chalk range its whole distance; it is seen near at home in Reigate Park and Redhill Common, and in the continuation of that line of hills east and west. For the most part it is lower than the chalk range, but Toys Hill is an exception eastward; westward, there are long ranges of hills, as Leith Hill and others, considerably higher than the chalk range. Toys Hill overlooks a very extensive tract of country, and the view therefrom is very fine. Its elevation is over 800 feet. Lying a little more east than Toys Hill, on a clear day may be traced a far distant range of hills; these are the North Downs appearing again. Leaving Reigate their course lies to the N.E. to Chatham, where they are cut down to the sea-level to allow of the escape of the waters of the Medway. Having, as it were, opened the gates for this important river, their course lies to the S.E., and in time they come again into view from Reigate about Hollingbourne Hill, distant about 40 miles; they then gradually fade from sight, and in place we have in view the neighbourhood of Tunbridge Wells, and its numerous houses, distant about 20 miles. A little to the S. of E. we see by aid of a telescope Frant and its church. From the top of Frant Church is an exceedingly beautiful prospect. When the Government survey was being made, the surveyors built a stage on the top of the church, from which place was seen the sea at the Nore, also between Hastings and Rye, and again about Hythe. I myself saw from the church tower the smoke of a steamer as it passed down by the Nore. The high land of Eridge (Lord Abergavenny) and its woods terminates the landscape in the immediate neighbourhood of Frant. In connection, however, with the range of hills, which is the central range of the Wealden series, we notice from Reigate a conical hill like a cloud rising up from the general level. This is Crowborough, on which in ancient times was a beacon. Its elevation is about 820 feet; it is the highest point of the Wealden, and ought to be a point of commanding prospect. Notwithstanding its conical appearance as seen from the W., it is not really so. The N. and S. sides are comparatively steep, but E. and W. the land slopes gradually, and in consequence of the trees, the prospect westward is very disappointing. Some gentleman has built a house on the crown of the hill, with a tower attached, from which I apprehend there must be a very commanding view all round, and especially westward, for there is no ground so high between it and Leith Hill, in Surrey, and Black Down, in Sussex. A little nearer home, about south of Edenbridge, is another more northern range of the Wealden, parallel to the range of which Crowborough forms a part. There are remarkably fine views of the North Downs from these hills. You will notice on what appears to be the most westerly point, that is the point nearest home, a clump of trees of triangular shape. This is Dry Hill. On this are the remains of a Roman encampment, of which I heard one evening coming home in the train with

the late Mr. Harvey, incumbent of Cowden, which place lies at the foot of the hill. Dr. Bossey and I made two journeys, endeavouring to find the remains of the encampment, and although each time we were in the adjoining field, we missed the object of our search. I afterwards found it. It seems the camp was about a quarter of a mile in diameter, but a considerable portion is hidden by a copse. The view west from this point ought to be very good, but unfortunately the trees again interfere, and there is no clear space on the higher ground which permits of an uninterrupted view west, but the prospect N. and S. is very fine. Crowborough stands out comparatively mountainous. Towards the S.E., the middle and southern ranges of the Wealden series again bound the view. It has been said that Fairlight, near Hastings might be seen from Reigate, but I believe the Wealden range intercepts the view. Further to the south we have occasional glimpses of the South Downs, which about the extreme limit of vision in that direction tend to the S., and terminate at Beachy Head. Beachy Head itself cannot be seen because the Downs dip to the south, the higher parts being the nearer to this part of the country. At intervals, I said, we see over the Wealden range, and catch the higher points of the South Downs until we come nearly due south from Reigate, where we have Ditchling, on which at one time was a beacon. I remember seeing the pole on which the beacon was raised. That has, however, fallen or been removed. The Devil's Dyke, or rather the hill above it, is visible from Reigate. A prominent feature in the landscape is Changtonbury Ring, at the back of Worthing. Here we note that the Wealden range near Horsham intercepts the view of the South Downs; and there is a remarkable tower in a wood on the top of a hill N. of Horsham, which is a prominent landmark from Reigate and the neighbouring elevations. Passing to the S.W., a longer stretch of the South Downs may be seen, among other points Kingley Down, near Chichester, from which is a magnificent view of the Isle of Wight, Hayling, and Portsmouth, and the inland waters in that vicinity. I am not acquainted with the most distant points of the South Downs east of Leith Hill, but we note Leith Hill itself with its tower. This is on the lower greensand, and is the highest elevation of that series, being 993 feet above the sea level, and is the highest land in the S.E. of England. The prospect from Leith Hill does not come under description this evening, but I may state that it takes in Inkpen, 60 miles to the W., and Hollingbourne, 40 miles to the E.; Buckinghamshire to the N.; and the sea in one point to the S. Turning still more W., and lying at the back of Leith Hill, we notice on a clear day two rounded mounds in the far distance, looking like clouds. This is Hindhead Common, near Haslemere, also on the lower greensand formation, and second in height only to Leith Hill, about 953 feet. Black Down, a commanding hill of the same formation stretching out from Haslemere eastward, is hidden from Reigate by Leith Hill. It may be seen from White Hill, near Caterham, and also from the mill at Bletchingley, but is not strictly in our programme. A little N. of Hindhead Common, and appearing like a faint streak, may occasionally be seen the continuation of

the North Downs as they round towards the south after passing the Hog's Back. This line of hill runs W. of Petersfield, and joins the South Downs at Butser Hill, near Petersfield, completing the rampart which bounds the Wealden series to the W. Butser Hill on the chalk may be seen from Leith Hill, but I doubt it being seen from Reigate; it is over 900 feet, and commands a view of Winchester and Salisbury Cathedrals. Crooksbury Hill is within our view, but is best seen from St Martha's Hill, nearer Guildford. We have mentioned the Hog's Back, where the chalk range is narrowed to a mere ridge. The old coach road from Guildford to Southampton runs on the top of this ridge, giving a commanding prospect on each side for about six miles of road. The extreme end of the Hog's Back is in view. The prospect is then limited to the valley between the greensand range and the chalk range as far as Gomshall, a valley exceedingly rich and beautiful, which continues to our feet. Quitting the knoll on which we have in imagination stood so long and enjoyed so delightful and varied a prospect, we take the road towards Walton Heath, and again commit trespass by going into a field near the road, but it is scarcely worth while doing so, for although there are occasional glimpses from the field at the north of the beeches of the country in the direction of Windsor and extending over to Buckinghamshire, the high land on Walton Heath and the trees in the immediate neighbourhood obscure the prospect.

Here I think I have completed the round. Not that I have described a tenth part of the beauties of the prospect; my subject was the *extent* of the prospect, not a description of it. Summing up the extent, the view from N. to S. extends about 55 miles; from E. to W. about 80 miles; and taking the extreme points visible all round they embrace about 2,200 square miles. It has been said that the sea can be seen from Reigate Hill. This I am persuaded is a mistake. The elevation of Reigate Hill at its highest point is about 760 feet above the level of the sea, and the knoll is about 700 feet. The limit of vision down to the sea-level is about 34 miles, supposing no high land to intervene; but between the sea and Reigate are the South Downs, having an elevation of at least 500 feet, and in some places 700 feet. There is no gap until Shoreham, and the angle of opening is in the wrong direction to see through it from Reigate, although it is open from Leith Hill. But then Leith Hill is five miles nearer the coast than Reigate Hill, and is 200 feet higher. Within the circle of the prospect are the head waters of the Wey, the Mole, the Darent, the Medway, the Rother, the Ouse, the Adur, and the Arun, besides smaller streams which take their rise on the northern slope of the North Downs, such as the Wandle and the Ravensbourne. If my hasty sketch has afforded interest then I am rewarded; my review of the prospect is pleasant to myself, and I think it would be to all who may have the opportunity of studying the prospect itself.

Some discussion followed the reading of the paper, as to the alleged instances in which the sea, or objects upon it, are stated to have been seen from Reigate or the neighbourhood. In particular one instance was re-

ferred to by the President in which a ship on the sea was distinctly seen from Redstone Hill. These instances were explained as being phenomena similar to the mirage sometimes seen in the desert, and to be due to either reflection from a cloud surface (possibly a *double* reflection), or to refraction.

EVENING MEETING, *Jan. 9th*, 1880. Mr. Tyndall read some "Meteorological Notes for the year 1879," and presented a table of statistics of the Meteorology for the year.

The Barometer was high during the last three months of the year, reaching to 30.74 on the 23rd December, which, reduced to the sea-level, would give about 31in. On 161 days it reached 30in. and over; on 202 days 29in. and over; on two days it fell below 29in. The lowest was 28.98, on the 7th April.

The Thermometer in the shade (north aspect), never reached 80°; the maximum being 79°, on the 29th July. The mean temperature was below the average for every month; the greatest deficiency being 7°.84, in December; the next 6°.35, in November; then 6°.13, in May; and 5°.89, in January. The least deficiency was 1°.42, in February; then 1°.89, in September; and 1°.93, in June. On 18 days the temperature never rose above 32°; viz., on 12 days in January, 1 in November, and 5 in December. On 126 days it fell in some part of the day below freezing; viz., on

29 days in January.	
14 " February.	
18 " March.	
10 " April.	

5 days in May.	
3 " October.	
19 " November.	
28 " December.	

With one exception, on the 14th December, when it did not sink below 32°.5, it fell to the freezing point for 39 consecutive days.

The rain has been excessive during the year, amounting to 38.02 inches; the average for Redhill being about 28in., and for Kew 26.26in. The amount exceeded the average in every month except March, October, November, and December. The heaviest fall was in August, 5.57in.; then June, 4.99in.; July, 4.53in. The least was in March, .69in.; then October, .96in.; December, 1.14in.; and November, 1.59in. The total number of rainy days—that is, days in which .01in. fell—was 189. The greatest number in a month was 23, in February; then 22, in March; and 21 in August. The smallest number was 9 in each of November and December, and 10 in January. Notwithstanding there were only 10 rainy days in January, 3.20in. fell in the month, being .76in. above the average. In regard to heavy falls of rain, 1.59 in. fell on May 28, 1.56 in. on Sept. 23, and 1.00 in. on Aug. 19. These were the only days recorded on which an inch and upwards fell in the period of 24 hours noted.

The other heavy rainfalls were:—

·88 in. on Jan. 1. }	·33 in. on June 30. }
·81 „ Jan. 2. }	·66 „ July 1. }
·84 „ April 15. }	·67 „ July 19. }
·25 „ June 1. }	·42 „ July 20. }
·70 „ June 2. }	·29 „ August 22. }
·68 „ June 24. }	·91 „ August 23. }
·51 „ June 25. }	·53 „ August 27. }
	·35 „ August 28. }

On November 20 and 21 there occurred a heavy fall of snow, equal to 1·09in. rain. This snow was very wet and dense, causing considerable damage to roofs and gutters, and breaking down a large portion of a fine cedar which extended over the Church Walk near Reigate old church. There was bright lightning and heavy thunder about 1 p.m. on the 30th December. The year was very deficient in sunshine, even when there was no rain. From Jan. 20 to Feb. 7, a period of 19 days, no sunshine seems to have been recorded at Kew; and extending the period to 22 days, viz., from Jan. 16 to Feb. 7, the amount of sunshine was about two hours. From Dec. 10 to 21 there occurred 12 days without sunshine. There have been comparatively few heavy gales, but an unusual amount of still air, with abundant haze; so that the season has been, upon the whole, dull. Crops have ripened with difficulty; pears which usually were ripe in August were gathered unripe in October, and even in November. The following additional table, furnished by Mr. Tyndall, shows the deficiency in the mean temperature of each month in 1879:—

Month.	Deficiency.	Average Mean Temperature.	Mean Temperature, 1879.
January.....	5·89	37°	31°·11
February	1·42	39°	37°·58
March	2·29	42°	39°·71
April	3·94	47°	43°·06
May	6·13	54°	47°·87
June	1·98	59°	57°·02
July	3·22	62°	58°·78
August	2·08	61°	58°·92
September ..	1·89	57°	55°·11
October	3·35	51°	47°·65
November	6·35	43°	36°·65
December	7·84	39°	31°·16

In reference to Mr. Tyndall's observations on the small amount of sunshine during the year, Dr. Bossey remarked that it was not so much an absence of sunshine as a deficiency of the actinic rays that had proved so disastrous to the crops of various kinds; as under their influence the chemical change in fruit, &c., is effected, by which the starch is converted into sugar, and the fruit ripened. This is of more importance to the crops than actual heat. Some conversation took place upon the peculiarly heavy fall

of snow on Nov. 21, and the many instances of the gutters of houses being broken by it. Dr. Bossey pointed out that this damage was not due to the weight of snow, but to the alternate partial melting and freezing that took place, the actual cause of breakage or injury to the gutters being the expansion of the water when freezing. Mr. Tyndall made some remarks upon the most prevalent winds, stating that the N.E. and S.W. are the most so, the S. and N.W. are but little prevalent, and the S.E. least of all; this wind often brings with it great cold in winter.

METEOROLOGICAL STATEMENT FOR THE YEAR 1879. OXFORD ROAD, REDHILL, SURREY.

	Barometer. At 8 a.m.				Thermometer.							Rainfall.		No. of days with Rain or Snow.
	Max.	Date.	Min.	Date.	Max.	Date.	Min.	Date.	Aver. Max.	Aver. Min.	Mean.	Rain in Inches.	No.	
January.....	30.25	19	29.46	3	49	3	16	10	35.90	26.32	31.11	3.20	10	10
February	30.06	1	28.99	17	51.3	9	22	23	42.46	32.70	37.58	4.03	23	23
March	30.55	8	29.54	27	60	19	24.5	1	47.52	31.90	39.71	.69	15	15
April	30.25	29	28.98	7	59	26	23	11	51.35	34.77	43.06	3.21	19	19
May	30.46	5	29.60	18	67.5	21	27.5	9	57.19	38.56	47.87	4.26	19	19
June.....	30.15	14	29.45	3	69.5	14	40	2	65.77	48.28	57.02	4.99	22	22
July	30.18	28	29.50	21	79	29	41.3	26	65.77	50.79	58.78	4.53	18	18
August	30.16	2	29.55	17	76.3	14	37.5	31	68.18	51.67	58.92	5.57	21	21
September ..	30.45	2	29.45	24	71	16	36	25	63.51	46.71	55.11	3.80	11	11
October	30.52	12	29.41	20	64	1	29	16	55.29	40.01	47.65	.95	13	13
November.....	30.55	8	29.80	21	54	18	13	22	42.55	30.75	36.65	1.59	9	9
December.....	30.74	23	29.54	4	52	31	7.5	6	38.85	25.47	31.16	1.14	9	9
												38.02		189

Mr. J. B. Crosfield read a paper entitled "Notes on Ornithology for 1879." He gave some particulars relating to the songs of birds, especially as to the way in which they were affected by the cold and wet season. He also mentioned some observations respecting the nesting of rooks, and

referred to the distribution of the curlew in this neighbourhood, where it seems to be confined exclusively to the chalk, upper greensand, and gault, not being met with, so far as he had observed, on the lower greensand or Wealden. Mr. Whitehead stated that a common tern was observed last summer at Gatton Lake.

Mr. A. Bennett exhibited specimens of *Scirpus parvulus*, a species which was found in 1878 by Dr. Crespiigny, at Mortlake, and which thus forms an addition to the Surrey Flora. This plant was first recorded in Britain in 1837; it was met with in 1868 at the mouth of the river Ovoca, in Ireland, and in 1872 at Lymington.

EVENING MEETING, *February 13th*, 1880. Mr. Gilford read a paper entitled "The Gault of Folkestone as elucidating the Gault of this district." He commenced by stating that the gault of Folkestone may be taken as a perfect type of gault, all the various beds of that series being there met with in the cliffs. De laance and Prof. Price map out eleven zones or beds of which the following are the descriptions in detail:—

Lowest Bed, or *No. 1, Zone of Ammonites interruptus*.—This is 10ft thick. Commencing with the junction with the lower greensand is found a seam of sulphuret of iron, 15in. to 18in. thick; then a band of dark greensand, containing a line of very large phosphatic nodules, which fall to pieces when tapped with a hammer. Above this line is a line of crushed *Ammonites interruptus*, with smaller phosphatic nodules; these crushed fossils and nodules are some of them covered with small crystals of selenite, never observed in fossils from the other beds. The dark greensand passes suddenly into black clay, in which is a line of phosphatic nodules. The sulphuret of iron seam contains large fragments of phosphatic wood. At the top of the junction bed is a crushed band of fossils 1in. thick, with line of phosphatic nodules running through it. *Am. Auritus Zone*, or *Bed No. 2*.—4ft. 2in. thick, is very dark clay, remarkable for the deep rich colour of its fossils. Three inches from the base is a line of selenite in large pieces, not occurring elsewhere; one foot above the selenite is a line of phosphatic nodules. *Zone of Crustacea*, or *Bed No. 3*.—4ft. 6in. thick, light or fawn or crab bed. Many *Inoceramus concentricus* are here. At the top of this bed is a line of nodules, with many rolled casts of fossils, backs of crabs, and bones of saurians and fishes; a fine type of *Inoceramus concentricus* is found in this line. *Zone of Am. Delaruei*, or *Bed No. 4*.—4in. thick, rather darker than No. 3, and not mottled like No. 5; at the top of this bed is a line of nodules, and rolled casts of fossils. *Am. Lautus Zone*, or *Bed No. 5*.—1ft. 9in., dark colour, spotted with light fawn markings. The coprolites in this bed are generally grooved underneath, and are very seldom grooved in the other beds; they are sometimes very long. This bed is easily traced on the beach by the number of coprolites with which it is studded, mainly in two broad bands, one at the top, the other at the bottom; they are either long or small and irregularly round in shape. *Am. Denarius Zone*, or *Bed No. 6*.—1ft., mottled, bed darker and more strongly mottled than No. 5, and very plainly defined on beach. *Am. Auritus Zone*, or *Bed No. 7*.

—6ft. 2in., top bed of lower gault, called the dark bed, but not quite so dark as No. 2. It is very fossiliferous. One foot from the top coprolites are found very round like marbles, or a smooth regular oval, and often contain fish scales or crabs' legs. *Am. Cristatus Zone*, or *Bed No. 8*.—10in. The nodule bed or junction bed between the lower and upper gault, containing many species common to both. Several lower gault species end here, and several upper gault begin here. It contains large nautili and ammonites. This bed and the next above are characterised by the presence of *Inoceramus sulcatus*; this has never been found in any other bed whatever, either at Folkestone or elsewhere. Even at Eastbourne, where some other fossils have a different range from what they have at Folkestone, the *Inoceramus sulcatus* is true to the nodule bed and the bottom bed of the upper gault. *Am. Varicosus Zone*, or *Bed No. 9*.—9ft. 4in., bottom bed of upper gault, called the half and half bed, because here and here only is found the hybrid form of *Inoceramus*, which is in part *sulcatus* and part *concentricus*, and is called *Inoceramus subsulcatus*. The half and half bed is easily distinguished on the beach by its many soft impressions of fossils. About a foot above the junction bed there is a seam of very hard marly gault filled with *Inoceramus sulcatus*; at the top of this bed is a line of nodules and crushed *I. sulcatus*. *Zone of Kingena Lima*, or *Bed No. 10*.—5ft. 1in. hard, pale grey, and marly, all the upper gault being marly. About 2ft. 8in. above No. 9 there is a line of nodules with *Plicatula*. The upper half of this bed is much mottled. *Am. Rostratus Zone*, or *Bed No. 11*.—Top bed of upper gault; pale grey, entire thickness being 56ft. 3in., or more than half the thickness of the whole of the gault. At the base is a seam of nodules with *Pecten*. At 35½ft. from the base there is a dark greensand seam 3ft. 3in. thick, called by Griffiths the middle greensand, a term adopted by Professor Price and others as very appropriate. This seam, which is at Folkestone 17ft. 6in. from the top of the gault, is at Eastbourne only one foot from the top. In this greensand nodules occur in lines, also a small species of *Inoceramus* and various other fossils. The gault immediately above this greensand is of the same marly character as that below, only much mixed with grains of sand for the first few feet. *Inoceramus crispus*, a large smooth species, occurs in the gault above the greensand.

A paper was then read entitled "The Entomological Phases of 1879," by Mr. Sydney Webb. He explained the general effect of the wet season upon the entomology of the year, comparing it with 1877; and referred to the extraordinary abundance of the Painted Lady, mentioning some of the reasons for and against the idea that they were an immigration from abroad. He also mentioned a few of the rarer insects taken in this country during the year.

Dr. Bossey read a paper entitled "The Life History of a Grass."

ORDINARY MEETING, *Friday, March 12, 1880*. The meeting proceeded to the election of a president in place of Mr. Sydney Webb, whose resignation of the office was tendered and accepted at the last meeting. It was proposed by the Secretary, seconded by Mr. Linnell,

and unanimously carried that Mr. Tyndall be requested to accept the office of President of the Club for the remainder of the present term.

Mr. J. B. Crosfield read a paper entitled "Notes on the Nesting of the Golden Eagle," as follows:—In the course of two visits to Sutherland, I have had some opportunity of observing nests of the golden eagle, and of inspecting two of them pretty closely. My first introduction to the ery of this splendid bird was in 1875 on the occasion of the first of the above mentioned visits to that wild county, which is ornithologically perhaps the most interesting in this island to a lover of birds, who enjoys visiting and observing our native species in their own homes, and is not contented with mere skins or with reading the records of others. On that occasion we happened to fall in with two shepherds, who told us they knew of an eagle's nest four or five miles off in which there was a young eagle. The afternoon was then well advanced, and our visit to the nest would involve a subsequent walk of some eight miles over the mountains, the latter part of which would probably have to be performed in the dark over country we were not then acquainted with in order to reach the quarters for which we were bound. However, we decided at once in favour of the nest, and put ourselves under the guidance of the shepherds. They took us to a deep, rather narrow valley with very steep sides, though not absolutely precipitous. Indeed in most parts, by a little selection of one's ground in advance, one could find a way up or down. I should estimate the height of the cliff at about 1,000ft. The nest was about half-way up, and was built against the face of a perpendicular rock, supported underneath by large stems of growing ivy, and perhaps also by some projecting rock. The approach to it was not difficult, involving little that could be called climbing. The nest was large enough to admit of three of us standing in it at once; it was about 6ft. by $4\frac{1}{2}$ ft., and consisted of a great mass of sticks, chiefly birch and mountain ash, ivy stems and heather, filled up with a variety of smaller materials, such as dead rushes, twigs, &c. One stick of mountain ash was nearly six feet long, and about an inch thick. We were told that the nest had then existed for at least twenty-two years; and as it was used by the birds last year, it has now been there for twenty-six years, and how much longer we do not know. If there ever had been any depression in the middle of the nest, it has doubtless long since been filled up by the accumulations of successive years; at the time of our visit it was a perfectly flat platform. The nest contained a number of legs of hares and portions of grouse; and one of the shepherds told us he had lately seen the legs of a lamb there. The young bird was a beautiful creature, completely clothed in soft white down, through which a few quill feathers were just sprouting. The toes and bare skin round the beak were pale yellow and soft like kid. Beak and claws seemed already strong and well developed; they were horn coloured. We judged that the bird weighed about five or six pounds, and had reason to believe it might be from a month to six weeks old. The shepherd said it would be nearly two months before it would be fledged sufficiently to leave the nest, and before that time he intended to take it to sell. Just below

the nest we found the empty shell out of which the eaglet had been hatched; and though a good deal broken and somewhat washed by the rain, after careful mending it made a very fair specimen. We saw nothing whatever of the old birds. At the other side of the valley, and far above, towers a grand mass of precipitous crag perfectly inaccessible, and in many places far overhanging. Against this, in a spot that was pointed out to us, though from a long distance, a pair of golden eagles have for many years had their nest, and this never yet has been and probably never will be reached by man. There is another nest in the same valley rather further up than the one I visited, but this I have not myself seen. It seems to belong to the same pair of birds that tenant the neighbouring nest, and they resort to it, if not in alternate years, at any rate occasionally. When I again visited the nest I have described last May, I found that the birds had used it, but the eggs had been taken by the shepherds before that time. On the 31st of May last year I visited another steep deep valley, one side of which consisted of a succession of grand crags rising range above range, some of them very sheer and precipitous, with much broken rocky ground between the various tiers and masses of cliff. Our guide was again a shepherd, whose occupation constantly led him among these rugged crags, so that he knew well all the passes communicating from one accessible spot to another. He conducted us far up the steep side of the glen, to where an eagle's nest could be seen, some 50ft. above us, built on a projecting piece of rock against the side of a precipitous wall of cliff, at a place where two faces of the rock meet, forming somewhat of a corner. A small mountain ash sprang from the rock close to the nest. Our guide was tolerably certain this nest was unoccupied that year, but wishing to make sure of this, we ascended by a long circuit to a point at the top of the range of cliff, where by holding on to a little birch tree that projected over the edge we were able to look down into the nest, and satisfy ourselves that it was empty. The best chance of getting to this nest would be by a rope from above, though a tolerably long one would be necessary, as it must be a descent of 70ft. or 80ft. I feel little doubt, however, but that a really skilful climber with a perfectly cool head might ascend to it from below. We searched about among the neighbouring crags in hopes of discovering the present abode of the eagles; the shepherd thought very likely it might be among the rocks near the head of the valley, as he had noticed one or both of the birds about in that locality. We accordingly turned in that direction, and were much gratified to see one of the eagles soaring round and round slowly in circles at a great elevation, its broad blunt wings being never moved for minutes together. The ranges of cliff in this part of the valley were more broken and less steep than those further down; in one of them we all three noticed from a long distance a sort of recess or ledge, apparently just suited to the choice of an eagle, indeed just about such a site as that in which the nest of the white-tailed eagle is placed in Mr. Booth's splendid museum at Brighton. On examining the spot through our telescopes we could distinctly see that a nest of some sort was there, and as we got nearer, and could hear the cry of the young birds,

all doubts as to the species were removed. The eyry was about 50 feet above us, but as the cliff was somewhat broken and not too perpendicular, and, moreover, there were various plants growing between the rocks which afforded additional handhold, the ascent proved not particularly difficult; as a matter of fact the subsequent descent was much less easily accomplished. On reaching the eyry I found two fine young birds entirely covered with thick pure white down, and similar in all respects to the one already described. One was a little larger than the other, perhaps it emerged from the egg a few days earlier, or possibly it was a female and already showed the larger size attained by birds of its sex. The birds were both inclined to show fight, sitting upright in the nest and opening their beaks as if to peck. However I soon found their bark was worse than their bite, as one of them allowed me without resistance to touch and stroke it, and even to put my finger in its beak. Young as they were, however, their beaks were sufficiently formidable looking weapons, and had they been so disposed might have inflicted a severe wound. The rock above projected considerably forwards over the niche in which the nest was placed, so as to form a shelter for it. In size this nest corresponded very closely with the one previously described. It was formed of large sticks, dead heather-stems, tufts of heather, dead rushes (*Luzula sylvatica*), which grew plentifully among the rocks all about, moss, &c., piled together rather indiscriminately.

I do not know any other species of bird that seems to do so little in the way of construction or arrangement of materials as the golden eagle. Even such birds as the ring plover, terns, &c., whose nests are perhaps little more than a hollow in the sand or shingle, yet seem to pay some little attention to the arrangement of their materials when any are employed, but the golden eagle, so far as I can judge, accumulates its materials absolutely regardless of any arrangement or architectural design. I have noticed, however, that the nest of the golden eagle shown by Mr. Booth, which is no doubt perfectly accurate to the minutest details, does not consist of such a large mass of materials as those I have seen, and is perhaps a little more carefully constructed. I feel tolerably certain that this was an entirely new nest that year, and that I was the only person who had ever visited it. I judge this from the appearance of the materials, from the fact that there was a slight depression in the middle of the nest, that there were no traces visible on the rocks or weeds on the way up to the nest of any person having at any recent time climbed over them, and from the circumstance that the shepherd did not previously know of it, which he could hardly fail to have done had it been occupied in any former year. The only food in the nest were two legs of hares partly eaten. The old bird continued soaring round far overhead, and we afterwards saw her rather nearer, and could perceive that she had something in her claws, probably a rat or rabbit. I have lately been much pleased to hear from the shepherd that the two eaglets got safely off without any interference; they did not leave the nest until August, by which time they were almost as large as the old birds, and were fully fledged. From all I can ascertain about

the breeding of the golden eagle it seems that it occupies about five months of each year. If a new nest is to be built it is begun early in March, the eggs are laid about the last week in March or first in April, the young birds are hatched about the end of April, and are not ready to leave the nest till the beginning of August. They thus seem to take about three months in attaining their full size. Our guide afterwards showed us another nest at the lower end of the valley, which was, however, a good deal destroyed. It had been built about four years, and was occupied two years before we saw it; it was in a position perfectly easy of access, on a good broad ledge or shelf of rock quite covered above. I think there is every reason to suppose that all the three eyries in this glen belonged to the same pair of birds. It is said by some that golden eagles almost always select the southern or shady side of the valley for their nests, preferring a site where they get little or no sun. How this may be I do not know, but certainly all the nests I have mentioned are placed on the shady side of the crag or valley, and I think that a sunbeam can seldom or never fall on any of the four eyries that I have actually visited.

Sir Sidney Saunders delivered an address on "Fig Insects," explaining in the first instance that those whose life history he was about to narrate were not found in the domestic figs, but in those of various descriptions of *Ficus* in the wild state, subsisting on the seeds wherein their eggs were laid, and non-parasitic in their habits. Linnæus considered them to belong to the vegetable feeding Cynipidæ, but others have placed them among the parasitic tribe of Chalcididæ, whose mode of life essentially differs from theirs. Some of these fig insects have long been utilised by fig growers in the Levant for the process of *Caprification*, as adverted to by ancient writers, Pliny, Plutarch, and others; an operation still practised in modern times, which is deemed essential to promote the ripening of the domestic figs and prevent them from prematurely falling off the tree. This expedient consists in attaching to the cultivated fig trees bunches of the wild figs of *Ficus caprificæ* or *F. Caricæ* at the time when these insects are ready to emerge therefrom, and when the domestic figs are in a less forward state, whereby the pollen of the one may be conveyed to the other, as suggested by Linnæus and Latreille (*Hist. Nat.* tom. xiii., p. 204.) But different explanations have been propounded by other writers, all having assumed as a matter of fact that these insects actually penetrate within the domestic fig, of which, however, no evidence is extant. Pontedera had noticed these insects before Linnæus, as quoted by the latter (*Anthol.* 2, p. 172, Tab. xi.), having obtained them from the seed vessels of the wild figs. Tournefort also in his "*Voyage au Levant*," and in a *mémoire* to the Académie des Sciences at Paris in 1705, enters fully into the system of caprification, without explaining how the influence of these insects was supposed to operate, simply affirming that otherwise the domestic figs not ripening, would fall, and the cultivators lose their crops. Another French writer, M. Bernard, declares that he could never find any of these insects in the cultivated figs; while remarking that even supposing them to force

occasion obviously point to these universal associations of winged and apterous types as intimately related to each other; and neither of these types being parasitic, but all vegetable feeders subsisting alike within the seed vessels of the fig, and having no other associates therein, they can only derive their existence from the same parental origin, and constitute *inter se* the two sexes of the respective species. Further observation in support of this conviction has led to the verification of the mode whereby impregnation is effected in *Blastophaga*, before the female emerges from her cell in the pericarp; wherein she nibbles a small aperture in the first instance, showing only a portion of her head as a black speck, her antennæ concealed within, in which position she remains curled round and quiescent for a day or two, awaiting the addresses of any rover in search of a mate, one of which is now exhibited perched upon the summit as found and retained intact *in situ*. An analogous instance may be cited in *Oiketiscus* and *Psyche* among the moths; although in these the females are apterous and their partners winged, the reverse obtaining in these denizens of figs, where all being confined together within a limited space, the male has no need of wings, which are essential for the dispersion of the females. Eventually the female enlarges the orifice, availing herself of her serrated mandibular appendages for this purpose; but when the fig is cut open the seed vessels soon assume a pergameneous consistency, and retain their hapless captives by the shoulders while vainly struggling to emerge, as exhibited in several specimens. The males, however, effect a large breach at once, and are the first to emancipate themselves. After the females are freed from the pericarp they have still another barrier to penetrate before they can effect their escape from the closed fig itself; for which purpose the *Sycophagæ* make a series of holes around the stamens affixed to the crown of the fig, which becoming detached affords the brood an ample passage. The males, however, never quit the fig, but are found dead within at this period. The natives of Egypt, though uninitiated in the arcana of caprification for their domestic figs (which abound notwithstanding), are accustomed to make a slit in each Sycamore fig to promote its distension, or otherwise they never ripen, thereby facilitating also the egress of their inmates, and relieving the unconscious consumer from the presence of such unwelcome guests; the defunct males being inappreciable and resembling portions of the fig itself.

Thus in the instincts and economy of these minute races, endowed with abnormal structural appliances adapted to peculiar functional requirements, a farther illustration is afforded of the many mysterious phenomena which court investigation in this prolific field of research, where new phases of wonder and admiration are constantly elicited, and some of the most intricate problems, involving physiological questions of no mean import, are open to enquiry, for the elucidation of which the mere discrimination of individual species is but in itself the first stepping stone.

EVENING MEETING, April 9th, 1880. Mr. Bennett exhibited a growing specimen of *Hierochloa callosa*, the Northern Holy Grass, grown by him at Croydon. This grass was discovered by Robert Dick in Caithness-shire.

He also exhibited a specimen of *Caltha radicans*, from a plant grown by him at Croydon, descended from the plant found by Don in Forfarshire in 1798, the only instance known of the occurrence of the species in the British Isles; the only existing station in Europe for this species is Gothland.

The Secretary read a paper by Mr. Sydney Webb, entitled "The Nomenclature and Arrangement of British Lepidoptera, with a few suggestions thereon."

Mr. Herbert Crosfield read a paper written by Mr. Edward Saunders on "The Pollen-collecting Bees of Great Britain," as follows:—

I have been asked to write a short paper to be read at the next meeting of your Club, and as I have lately been specially occupied in the study of the pollen-collecting Hymenoptera or bees of this country, I thought a few remarks on some of their peculiarities, and especially on one of their chief peculiarities which has hitherto received very little attention—viz., the hairs on which they collect their pollen—might be interesting to your members. Although nearly every one knows a hive-bee when he sees one, yet there are many other kinds of bees in England, known by the general name of wild bees, which are not so well known, and therefore it will perhaps be well first to define what I mean by a bee, that we may know what sort of creatures we are going to think about. The older entomologists used to divide the kingdom of insects into two great divisions by the form of the mouth, distinguishing those that have lateral jaws or mandibles, which they called the Mandibulata, from those which have simply a ductorial mouth, which they called the Haustellata. Dealing with the perfect insect or imago, this division is admirable, and for our purpose to-night will be amply sufficient. The whole of the tribe of bees are armed with mandibles, and therefore belong to the former of these sections, and in the same section with them we find the beetles, the dragonflies (including the Ephemera and allied groups), and the grasshoppers (including the cockroaches, earwigs, &c.). We have now to distinguish our bees from these three allied orders. From the beetles and grasshoppers they may be readily known by their four clear membranous wings. From the dragonflies, &c., which have also four clear wings, they may be known by the neurulation of these organs. In the dragonflies the nervures of the wings are so numerous and close together that they form a sort of network, whereas in the bees they branch and form the boundaries of a certain number of tolerably large cells, which vary much in size and position. I think therefore we may take it for granted that if we have found an insect with a mandibulate mouth, and four clear wings with branching nervures, that insect belongs to the order Hymenoptera. There are exceptions to this rule, but these exceptions are few, and the rule is useful and good enough for general purposes. The Hymenoptera again are divided into several sections, but the true bees, or pollen-collectors, may be known from all the others by having branched or plumose hairs on their bodies. Nearly all the Melliferae, as they are called, collect pollen, but

there are a few species which are parasitic on others; these have been called Cuckoo bees. They appear to collect no pollen, and have no special apparatus for the purpose. The females only have specialised organs for collecting pollen, and they may be known from the males because they have six segments only to the body, whereas the males have seven; but then the female has a sting, whereas the male has none, and it has been presumed by many that the sting of the female is really only the seventh segment in a contracted form.

There are two great divisions of the Melliferæ known as Social Bees and Solitary Bees. The Social bees live in large numbers in the same hive or nest. The Solitary bees live in pairs only, one male and one female in each. In the Social bees exists what has been called a third sex, viz., the worker; but these workers are really only undeveloped females, and of late years it has been shown that a worker can even produce fertile eggs, but that eggs so produced always turn to males, never to workers or females. The workers have the same pollen-collecting organs as the females, and, as their name implies, do the collecting for the hive or nest. Males may often be found with a good deal of pollen on their hairs, but they have no regular apparatus for collecting it. All the Social bees collect their pollen on the tibiae or shins of their hind legs, which are outwardly smooth and slightly concave, and fringed on each side with long hairs, forming what has been called a "Corbicula," or basket, in which the pollen is taken home. But among the Solitary bees some collect on the tibiae, others on the under side of the body or stomach, if we may so call it; and in this group those parts on which the pollen collecting takes place are generally densely covered with hairs; and it is to the arrangement and formation of these hairs that I wish especially to call your attention. As I have said above, all the pollen collectors have more or less plumose hairs; in some these plumose hairs are found nearly everywhere on the body, in others only on particular parts. The appearance of plumosity is caused by the hairs being branched; the branches generally spring from all sides, and therefore in the very densely plumose hairs the whole has the appearance more or less of a brush. The variation in structure is very remarkable. In some the main stem bears such short branches that they look merely like the teeth of a saw; in others the branches are long and curved. In some the branches are thick, as thick in fact at the base as the parent stem; in others they are filamentary or thread-like. In some the whole hair is shaped something like a young tree; in others the branches are so compacted together that without a strong lens the whole hair looks like a scale. There are others again where all the branches spring from one side only. Nearly every variation seems to exist between these extreme forms. Besides these branched hairs there are simple hairs, spirally grooved hairs with simple apices, spirally grooved hairs flattened at the apex into a sharp spade-like edge, and spirally grooved hairs flattened near the apex into a sharp lateral knife-like edge. Anyone looking at a series of our British bees would see a great difference as to

the length and density of the hairs on their bodies. There are the Bumble bees, which as we all know are densely covered with long hairs, besides others which resemble them in this respect; then there are a good many which have a densely hairy head and thorax, and an abdomen more or less banded with pale or white hairs as the case may be, which hairs are often closely pressed down on the surface of the body; others have these adpressed hairs also on the thorax; others, again, are almost naked, and one has a difficulty in observing hairs on them at all. Now, as a rule, the dense long pubescence like that on the bumble bees is made up of more or less shortly branched hairs, the adpressed pubescence such as that of the abdominal bands mentioned above is made up of the very closely and compactly branched hairs. The hairs of the pollen-collecting apparatus, whether on the tibiae or the under side of the abdomen, vary exceedingly in form; in some species they are simple, in some rigid and branched, in others flexuous and branched, in others rigid and spiral; and this variation seems to me to be particularly interesting, especially since in two closely allied species which have the hairs of the thorax almost identical in shape, the hairs of the pollen apparatus may be utterly different. The object of this variation is what I want to discover. It evidently, I think, has some direct bearing on the process of pollen collecting, because it occurs so prominently on the organs set apart for this purpose; and it is probable, to my mind, that in some way it will be found to correspond with the variation in the flowers from which the bees collect their pollen, or in the nature or shape of the pollen grains themselves; for instance, it is quite possible that those bees which visit flowers whose pollen may be particularly viscid would only require simple hairs to collect it on, whereas those which visit flowers with less viscid pollen might require hairs branched, so as more surely to hold it when received. All this is of course conjecture, but I think it is a subject well worth any microscopist's while to study and try to work out, and I would earnestly commend it to any members of your Club who may be inclined to work at a subject of which so little is known.

There are yet other hairs which I wish to submit to your attention. These are the hairs with flattened apices; they occur on the inner side (*i.e.*, the side towards the body) of the hind tibiae and tarsi, and I believe they exist on most of the known species. I have little doubt that they are useful for cleaning purposes, especially for removing the pollen when the bees get to their nests. On the front legs of the bumble bees, and I have no doubt of others too, there are somewhat similar hairs, but the sharp edge is lateral, and not apical, so that the hair resembles a knife instead of a spade. One occasionally sees an insect cleaning itself, and the movements of the legs in that operation would, as far as I can see, exactly bring the sharp edges of the hairs into play, the movement of the hind legs being more vertical than that of the front legs. I feel convinced that I am not over-rating the value of these hair peculiarities; they have already afforded me a character by which to separate the pollen-collecting bees from the wasps and other sting-bearing Hymenoptera; for although these had long ago been

separated off on account of their habits, yet I believe there was no character known by which to separate them for certain by their actual structure; therefore this character of the hairs, directly related as it is to the habits on account of which the Melliferæ have always been considered a distinct family, seems to me most valuable, and should lead, if persons can be found to help in working out the subject, to further useful results in our knowledge of the Hymenoptera.

ANNUAL GENERAL MEETING, *October 8th*, 1880. The Annual Report for the past year was read, and was as follows:—

ANNUAL REPORT, OCTOBER 8TH, 1880.

In presenting their Annual Report, the Committee have to record that during the past year fourteen new members have joined the Club, which is a larger accession than usual. Two members have died, and one left by resignation, so that the membership now amounts to seventy.

Winter Evening Meetings. Papers have been read or addresses given on the following subjects:—

- "Young Birds in the Down," by Mr. Edward Bidwell, of London, November 14th.
- "Man's Influence on the Flora of the neighbourhood," by Mr. A. J. Crosfield, November 14th.
- "Thames Mud in relation to Sanitary Science," by Dr. Bossey, December 12th.
- "The Extent of the Prospect from Reigate Hill," by Mr. W. H. Tyndall, January 9th.
- "Meteorological Notes for the year 1879," by Mr. W. H. Tyndall, January 9th.
- "Notes on Ornithology for 1879," by Mr. J. B. Crosfield, January 9th.
- "The Gault of Folkestone as elucidating the Gault of this district," by Mr. W. Gilford, February 13th, illustrated by specimens and a geological map.
- "The Entomological Phases of 1879," by Mr. Sydney Webb, February 13th.
- "Life History of a Grass," by Dr. Bossey, February 13th.
- "Notes on the Nesting of the Golden Eagle," by Mr. J. B. Crosfield, March 12th.
- "Fig Insects," by Sir Sidney S. Saunders, March 12th.
- "The Nomenclature and Arrangement of British Lepidoptera, with a few suggestions thereon," by Mr. Sydney Webb, April 9th.
- "The Pollen-collecting Bees of Great Britain," by Mr. Edward Saunders, April 9th.

Many of these papers were of great interest, containing much information that was new to many of the members present. It is intended to print some of them in full in the next number of the Printed Proceedings of the

Club. Several are very suggestive, and afford material which may profitably be worked up by any members of the Club who may be disposed to pursue the subjects further. Mr. Bidwell's paper was admirably illustrated by his beautiful and unique collection of young birds in the down, comprising upwards of forty different species. Interesting discussions ensued on the reading of this and many of the other papers.

Exhibitions, Records, &c. Mr. Sydney Webb exhibited specimens of *Nonagria sparganii* bred by himself, being the first instance recorded in this country. He also exhibited a Camberwell Beauty (*Vanessa Antiopa*) caught in the neighbourhood in 1877.

Mr. J. B. Crosfield recorded having found *Sparassis crispa*, a somewhat rare fungus, on the Addington Hills, near Croydon, in September, 1879.

Mr. A. Bennett exhibited specimens of *Scirpus parvulus*, a species of rush, which had been found in 1878 by Dr. Crespigny at Mortlake, and thus forms an addition to the Surrey Flora.

Mr. J. B. Crosfield recorded the following rare birds which had lately been brought to Mr. Reeves, of Holmesdale Road:—A Great Gray Shrike shot near Godstone, about February, 1880; a Hoopoe killed at Tandridge, August 16th, 1879; and a Bittern killed between Godstone and Edenbridge, during the winter of 1879-80.

Meteorology. Notes on the Meteorology of the year 1879 were furnished by Mr. Tyndall, and showed some remarkable facts regarding the weather of that year, particularly as to the low temperature and excessive rainfall.

Summer Excursions. The following out-door meetings were arranged for, five occupying the afternoon only, and five the whole day:—

WHOLE DAY.	AFTERNOON.
May 8. Edenbridge and Toys Hill.	April 24. Ranmer Common.
June 23. Dover.	May 22. White Hill.
July 24. Crawley, Tilgate Forest, and Balcombe.	June 12. Tilbuster Hill.
Aug. 25. Dry Hill.	July 10. Betchworth and Buckland Hills.
Sept. 18. Gomshall, Abinger, and Leith Hill.	Aug. 14. Headley Lane.

Owing to the wet weather the excursion to Leith Hill did not take place; that to Dry Hill was also omitted from other causes.

May 8. Toys Hill. Amongst the plants met with on this excursion may be noted *Veronica montana*, *Cardamine amara*, and *Ribes nigra*.

June 23. Dover. This excursion formed an agreeable exception to the usual custom of the Club of confining its excursions to our own district. It was undertaken at the invitation of Mr. Sydney Webb, the late President of the Club, who has recently been residing at Dover. To him the best thanks of the Club are due for the trouble he took on the occasion in conducting the members to the localities best worth visiting, and introducing them to many species botanical and entomological not to be met with in the neighbourhood of Reigate, and also for the hospitality with which he entertained the party. Among the plants found may be mentioned the following:—*Euphorbia Cyparissias* (supposed by Professor Babington to be

E. Esula), found in one situation on the downs abundantly; *Rubia peregrina*, growing on the beach among shingle at the foot of the chalk cliffs; *Smyrnium Olusatrum*; *Brassica oleracea* and *Diploxys tenuifolia* on the face of the cliffs; *Orobanche amethystea* and *O. caryophyllacea* in several places on the undercliff west of Dover; *Silene nutans* and *S. maritima*; *Ophrys aranifera*; one or two specimens which had rather passed off were found on a portion of the undercliff in a place where the species is said to be met with abundantly when in flower; *Hippophaë rhamnoides*, also found on the undercliff; *Lactuca virosa*, growing abundantly in the shingle, but not yet in flower. The entomologists found the Broad-bordered five-spotted Burnet (*Zygæna trifolii*) in abundance flying just above the long grass in a field beyond Diggle's Folly. Another locality was passed in the evening at the top of the cliff between Folkestone and Dover. The three Foresters (*Procris Statices*, *P. Globulariæ*, and *P. Geryon*) were searched for, but as it was cloudy, without success. They are all to be found in a locality behind the town, each species keeping to its own few square yards. Near the same spot was found the larva of the Emperor moth (*Saturnia carpinii*) feeding on blackberry. Along the undercliff by the seashore were found larvæ of the Dew moth (*Setina irrorella*) feeding on the stone lichens. On a level portion of the undercliff covered with *Anthyllis vulneraria*, *Hippocrepis comosa*, &c., were found numbers of the Grass Rivulet (*Emmelosia albutata*), also the *Pyrælia* (*P. fuscalis*), and the Shaded Pug (*Eupithecia subumbata*). The pupa of the Fiery Clearwing (*Sesia chrysideformis*) could not be found, though fairly numerous in the locality in the stems of the docks growing among the shingle. Along the beach were found the following rare micros:—*Coleophora conyzæ*, *Eudoria ambigualis*, and *Cochylis alternana*.

July 24. Tilgate Forest, &c. Near Balcombe a large number of white specimens of the common Centaury (*Erythraea Centaureum*) were noticed in flower in various places, indeed the white variety seemed almost as common as the red. In the Forest, *Campanula hederacea* was found in great profusion, and in localities probably two miles apart. In some places it was noticed growing among the grass bordering the roadside for a considerable distance. *Anagallis tenella* was also found in one situation growing along with the *Campanula*. *Lastrea Oreopteris*, a fern not common in our district, was met with plentifully. Other plants found were *Hypericum Androsaemum* and *Genista tinctoria*. In a small stream, trout about nine inches long were noticed in some of the pools.

August 14th, Headley Lane.—A few very small plants of *Ceterach officinarum* were found on the wall on which this species has been known to grow for many years past. It is probable that when the specimens attain to such a size as to be noticeable they are soon removed by collectors; but as the wall is of considerable length, and is abundantly covered with *Asplenium Ruta-Muraria*, it requires a rather careful search to find the *Ceterach*; there seems, therefore, a good chance that it may hold its own for some years to come. *Hypericum calycinum* was found in flower during this excursion.

Prizes.—A first prize of £1 was awarded to Mr. Ernest E. P. Tindall, Redhill, for a collection of beetles, and a similar one to Miss S. E. Marriage, Meadvale, for a collection of plants. It is to be regretted that fewer collections than usual were sent in to compete for the prizes offered.

Donations.—Several copies of "Notes on the Flora of Surrey," and a copy of the "London Catalogue of British Mosses," have been presented to the Club by Mr. A. Bennett, Croydon; specimens of shells and other objects by Mr. Simmonds, Cheapside, London; fossils by Mr. E. Horne; a bookcase by Mr. J. B. Crosfield; stuffed specimens of Hooded Crow and Kestrel, by Mr. A. W. Rosling; and two numbers of "Mycological Illustrations," by Dr. Bossey.

ABSTRACT OF BALANCE SHEET.

RECEIPTS.				EXPENSES.			
	£	s.	d.		£	s.	d.
Oct. 1879. Balance in hand	13	4	1	1879-1880. Rent of Museum, and Gas and Firing...	15	17	9
1880. Subscriptions received ...	24	16	0	Services of Assistant Curator ...	6	10	0
				Attendance, Cleaning, &c. ...	1	2	0
				Zoologist ...	0	12	0
				Commission, Postage, and Sundries ...	1	12	3
				Balance in hand ...	12	6	1
	£38	0	1		£38	0	1

The following gentlemen were then elected as officers for the ensuing year:—President, Mr. W. H. Tyndall; Treasurer, Mr. R. C. Baxter; Secretary, Mr. J. B. Crosfield; Curator, Mr. J. Linnell, jun.; Committee, Dr. Bossey, Dr. Holman, Mr. Marshall, Mr. T. Cooper, Mr. A. J. Crosfield, Mr. A. Bennett, Mr. W. Gilford, Mr. A. C. Sterry, and Mr. T. L. Aspland.

Mr. A. Bennett exhibited specimens of *Chara stelligera*, a species not before met with in this country, which he had discovered in Filby Broad, Norfolk, in September last. This species is met with on the Continent from Sweden to France. He also exhibited a complete collection of the British Characeæ and made some remarks in elucidation of the collection.

Mr. A. J. Crosfield exhibited specimens of some of the plants met with on the occasion of the excursion of the club to Dover, on June 23, including *Orobanche caryophyllacea* and *O. amethystea*, and *Euphorbia Cyparissias*. He also showed a number of specimens of rare plants found by him in

Teesdale, including *Polygala depressa*, *P. austriaca*, var. *uliginosa* *Cystopteris alpina*, and *Viola arenaria*.

EVENING MEETING, *November 12th*, 1880.—Mr. H. M. Wallis, of Reading, exhibited some bones from the peat and shell-marl of the River Kennet. Mr. Wallis explained the quaternary deposits of the Thames valley at Reading, by a diagram on the black-board of an imaginary section, showing the tertiary sands and clays of the Reading and Woolwich series resting on the chalk, and capped by gravels through which the Rivers Thames and Kennet have excavated their beds, and upon which considerable deposits of silt and peat have been made. In the gravel, bones of ox, horse, and elephant have been sparingly met with, whilst in one pit upon the Redlands estate the trunk of a pine tree was found. In gravel, 80ft. above the present river level, several flint implements of the shouldered palæolithic type have been found by Dr. Stevens, of Reading. During excavations made in 1872, 1873, and 1874, in connection with the town drainage, and again recently by the Gas Company, immense quantities of bones have been taken from the bed of the Kennet, and from the silt and shell-marl underlying the peat in the meadow adjoining the river. Many tons of bones of various ages and degrees of interest have been upturned—some few are human; others belong to the horse, hog, wild boar, beaver, wolf, dog, fox, red and fallow deer, *Bos primigenius*, *Bos longifrons*, and *Bos taurus*, and goat. These are associated with pottery of recent, and of Roman, Saxon, British and mediæval date, numerous implements worked of bone, such as awls, shuttles, winders, and salmon gaffs, also a yoke made of the antler of the stag, and some twenty or more species of fresh water shells, all of existing species. Mr. Wallis showed a human humerus from this deposit, also a very perfect bronze celt of an early type from the neighbourhood of Reading, and two flint implements (a hatchet and an arrow head) from the gravel.

EVENING MEETING, *December 10th*, 1880. Mr. Tyndall read a paper on "The Rivers of Surrey," as follows:—

In the following remarks upon the rivers of Surrey it will of course be understood that the subject presents no very prominent cases of importance, or of very marked interest, yet I believe that a few observations on the subject may embrace some interesting points of detail, and it is to be remembered that with the student of natural history points of detail are really those affording matter for most attention and for agreeable reflection. The casual observer hastily surveys a prospect from some commanding eminence, or gives a passing glance at a beautiful flower, or hurriedly notices the markings in a geological specimen, and is content therewith; but the student who takes the trouble to enter upon detail derives far more satisfaction from his observations. He attains to a knowledge of the subject which is engrafted permanently on the mind, the contemplation of which

is a source of never-failing enjoyment. I may state at the outset that in my remarks on the rivers of Surrey I omit altogether Father Thames, notwithstanding that river forms the northern boundary of the whole county, and is the most important of its streams. I treat of those rivers only which flow through the county, or have their rise within its boundaries, and flow into the Thames. But as a preliminary step, I must yet go beyond the boundaries of the county, in order to present to notice the general geological and topographical features of the district, upon the character of which the peculiarities of the several rivers of Surrey depend. We notice in Reigate and its neighbourhood the vast wall of chalk facing the south, which in a very marked manner presents itself to our attention. This wall of chalk is the steep side of the range of hills known as the North Downs. It is not confined to Surrey, but extends continuously in a N.E. direction to Chatham, in Kent, and thence continues in a S.E. direction to Folkestone and Dover, forming between those two towns the towering sea cliffs from 400 to 500 feet high, part of which is the well-known Skakespeare's Cliff. From Reigate westward the same wall of chalk extends to Guildford; from that point it turns to the S.W., and leaving Surrey enters Hampshire, running south, the steep face of the hills in that locality looking eastward, until the range strikes Sussex. It then again turns east, having the steep face of the hills toward the north, that is facing towards the Reigate Hills. These hills, here named the South Downs, terminate in the bold cliffs at Beachy Head. The summits of the northern range of this wall of chalk have an average elevation of from 300 to 400 feet above the valley which lies between the chalk range and the parallel range of the greensand, and an elevation of 600 to 800 feet above the level of the sea. In the northern range of chalk, which we may call *our* range, the hills are in five places cut down to the level of the greensand valley, viz:—Near Ashford, in Kent, by the River Stour; at Rochester, by the Medway; near Sevenoaks, by the Darent; at Box Hill, by the Mole; at Guildford, by the Wey. The two last named places are within the limits of our subject this evening.

There are three classes of rivers in Surrey. (1.) Those which have their sources south of the chalk range, and find their way to the Thames through deep depressions in the chalk, like those just referred to, of which the rivers Mole and Wey are instances. (2.) Those rivers which have their sources on the northern slope of the chalk formation, of which the Wandle and the Hog's Mill river are examples. And (3.) Those which have their sources in the Bagshot sands. In each case the ultimate course of all the rivers, except those having their sources in the Bagshot sands, is northerly; those rising in the Bagshot sands have a course eastward. All fall into the Thames. We will, if you please, commence on the eastern side of the county. There are several small brooks which I will not trouble you with, as the Effra at Brixton, which now forms a sewer. The first river of note is the Wandle. This has its sources near Croydon and Beddington in the gravel which overlies the chalk; and derives its water chiefly from springs which are the outflow from the chalk region. Its waters are very clear. It receives very

few tributaries from the drainage of the district through which it passes, and consequently it is little influenced by excessive rain either by increase of volume or discolouration. In connection with the Wandle, reference may be made to the Bourne from the Caterham Valley. Some of our friends present will have heard of and several have seen the Bourne, which after wet seasons in the autumn, bursts forth about March in the Caterham Valley, and runs into and down Smitham Bottom, parallel to the Brighton Railway, entering Croydon, where it falls into the Wandle. Along the course of the Bourne, and especially near its source in Marden Park, the land becomes saturated from overcharged springs, which ultimately form a river of clear water, passing Caterham Junction in a channel about 4 feet wide, and with a rapid current. That this stream is the accumulation of water from springs, and not surface drainage, is I think evident, because it is not turbid, as water from surface drainage usually is in this part of the country after heavy floods. It is supposed to be the discharge of a subterranean reservoir, which having been filled to a certain height, the waters are drawn off as by a siphon. I apprehend the sources of the Wandle are the overflowing of springs from the chalk district, rising out of the gravels which overlie the chalk in the neighbourhood of Croydon and Beddington, but not intermittent, as in the case of the Bourne. The Wandle river abounds with remarkably fine trout, and but few other kinds of fish are found therein. As the river approaches its termination in the Thames it becomes affected with the tidal water and is contaminated with sewage, and loses its transparency and general character, so that persons who know it only at Wandsworth would not recognise it as the same stream running through Carshalton or Beddington. The river and ponds connected with it rarely freeze.

(2.) A small stream rises near Malden, and falls into the Thames at Barnes. I know but little of this stream, and therefore cannot say much about it. It has nothing like the volume of water that the Wandle has, and, so far as I have been able to observe, it has not the brilliancy of that stream.

(3.) Still travelling west, the next river is the Hog's Mill River, which has its principal source in abundant springs at Ewell. This river is of similar character to the Wandle, rapid, clear, and abounding with trout. It falls into the Thames at Kingston.

(4.) The next river we have is the Mole. This is altogether of a different character to the others. It has its principal sources from the Wealden series, and to a large extent derives its waters from the drainage of the country. It is true that one considerable feeder has its sources in the Holmesdale Valley, one branch rising in the valley between Bletchingley and White Hill, but receiving its chief supply from the greensand, not from the chalk. Another feeder comes from Merstham, and this supply appears to arise more from the upper greensand than from the chalk. This is met again by a feeder from Gatton Park, also arising out of the upper greensand. This Holmesdale branch of the stream finds its way through a narrow valley in the lower greensand range at Redhill, where that formation is cut down to the level of the

Holmesdale Valley, and is the only outlet for the waters of that part of the country lying between Gatton Park on the west and White Hill on the east. The most southern limits of the Mole are in Sussex at a place called High Beeches, a little to the north-west of Balcombe Station. Passing through the Wealden clay, it carries with it a considerable portion of soil, and is for the most part, and especially when flooded, turbid, at least it is so compared with the Wandle. I may mention, as a matter of local interest, that one feeder of the river comes from Wray Common, crosses the road near the Vicarage, passes under Bell Street, and through Reigate Park, towards the Reigate waterworks. This stream at one time abounded in good trout; a gentleman whom I know when a boy caught them up to half a pound weight. The Mole, after having drained a triangular district, each of the sides of which extends about twelve to fourteen miles, is converged into a single stream at Box Hill, finding its way through the narrow valley at Box Hill to Leatherhead; but in this valley it undergoes a process of filtration, passing through a bed of gravel in Norbury Park, where in dry seasons it nearly disappears. It was at one period believed to occupy an underground channel, but it in fact only loses itself in a loose soil, re-appearing again near Leatherhead as a clear bright stream. It then finds its way through a narrow valley into the Thames at Moulsey. The length of the Mole is about thirty miles, and it drains about eighty square miles of land. (5.) The next river is the Wey. This river is also to some extent a river deriving its waters from the drainage of the country, but it is much more a river from springs than is the Mole. Its chief sources from springs are from the lower greensand, and it flows to a great extent through that formation. Its most abundant sources from that geological formation are in the neighbourhood of Haslemere, where the water may be seen issuing direct from the sides of the hills in copious streams, some of great purity, others charged to some extent with sand, which, however, is soon deposited. In former days within my memory every small stream in the neighbourhood and every pond of a few yards in diameter abounded with trout, but the fish are now confined to the larger streams and ponds. These streams from the greensand collect in a main channel between Farnham and Godalming, and thence proceed to Guildford, where the river finds its way through the chalk by a narrow valley. A considerable feeder to the Wey arises, however, in the east, out of the greensand at the back of Leith Hill, passing by Gomshall and Abinger, and falling into the Wey at Shalford. This tributary has its rise chiefly in springs, and is consequently a clear stream. The Mole, after it has passed the valley through the chalk, receives very few affluents during the remainder of its course, but the Wey receives a considerable tributary from the Bagshot sand, chiefly from the west, and also tributaries from the London clay and Bagshot sand on the east or right bank of its course. The tributaries from the Bagshot sand do not add to its purity, for that sand is to some extent charged with peaty deposit, which discolours the streams having their sources therein. The length of the Wey is about thirty-five miles, it drains about two hundred square miles of country, and

has been rendered navigable as far as Guildford. In former days a canal continued the navigation to the Arun, and thence to the sea. (6.) The sixth and last river to which I shall refer is the Bourn Brook, which has its principal sources near Bagshot and on Bisley Common, near the Chobham Ridge. This is almost entirely a river formed from drainage of the country. Its entire course of about twelve miles is through the Bagshot sand. It presents but few features of interest, is sluggish, and its waters have a stain of peat, like other streamshaving their sources in that formation.

Having regard to the geological formation of the country, it may be observed that the chalk strata and the upper and lower greensand strata have been thrust up and tilted by the upheaval of the Wealden series, so that in the range of the North Downs the gradual slope of the chalk is towards the north, and a like inclination exists in the strata of the greensands. When we come to the west side of the county, where the chalk retires into Hants, the lower greensand occupies a much more extensive area than in the east of the county. In the extreme west the tilt of the greensand and of the chalk beyond it is towards the west, the steep side of both formations facing the east; but whether the slope of the hills is north or west, in either case we find that the sources of those rivers having their rise in the chalk or in the greensand are from the land on the *gradual* slope of the hills, and not from land at foot of the steep side of the hills. I do not say that *no* streams issue from the steep side, but those which do are scanty in their supply of water compared with those which rise from the northern or western slopes. In the original condition of the chalk and greensand strata I apprehend the subterranean channels were horizontal or nearly so. When these series were thrust up and tilted by the upheaval of the Wealden series, the subterranean channels for water were tilted also; hence becoming charged with water in their lower termination, they broke through the ground in springs of more or less abundance. The chalk and gravels and sand would not afford much surface drainage, but would absorb the rainfall, hence in the northern surface of the chalk comparatively few drainage streams are found, but the waters burst forth as springs at various places down the incline. And on the northern or western sides of the greensands the waters find their outlet at foot of the northern or western slopes, not under the steep side or escarpment of the series. I have not been able to examine so fully the nature of the streams in the Bagshot sand, but perhaps some member of the Club can give information on this point. So far as my memory serves, they are sluggish and of dark colour, and hence the name of Blackwater, which is one of the principal streams of that series, but which is a river of Hants and Berks, not of Surrey. In the hands of some other member of the Club this subject might have been made more interesting; reference might have been made to incidents in connection with the rivers, to mansions on their banks, to parks through which the streams run, and to many other subjects which would naturally occur to a poetic mind, but which I regret have not come under my notice, or have not been retained in my memory, for I am sorry to say my imagination is like the

Bagshot streams, dull and slow, not fresh and free and brilliant as the Wandle.

Mr. Tyndall illustrated his paper by a coloured map of Surrey, showing the county divided according to its various river systems.

Mr. J. B. Crosfield read a paper as follows, entitled "A Visit to the Haunts of the Kentish Plover."

On the 29th May last I paid a visit to the sea coast, east of Rye, in the hope of having an opportunity of seeing the Kentish plover, a species that I have long wished to become acquainted with. In these islands this interesting and beautiful little bird is only met with on the flat shingly coasts of Kent and Sussex; and the wide expanse of shingle between Rye and Dungeness seems to be the district that suits it best. I kept a sharp look-out while walking over the flat country between Rye and the sea, but though I saw and heard many plovers, both in little flocks and singly, I always found them on examination to be the common ring plover. After walking a mile or two along the beach, I at last saw a pair that I strongly suspected to be Kentish plovers, and as I succeeded in getting a tolerably good view of them through my glass, I was soon able to confirm my expectations. I subsequently saw several others flying about over the shingle, which stretched away far inland. I expected it was just the right date for their eggs, and spent a long time in the search, although as there were hundreds of acres of shingle, all, so far as one could judge, almost equally adapted to the liking of the birds, the chance of coming upon them seemed almost hopeless. My attention was specially drawn to one pair which kept flying round me in wide circles, and occasionally alighting on the shingle, all the time uttering their whistling note, which is at once distinguishable from that of the ring plover, being much less shrill and plaintive. They also used another quick note, not a whistle, and still another frequently uttered, which is perhaps best described by the sound "trirr," as rendered in Dresser's "Birds of Europe." While flying round, the birds seemed very agitated, and constantly trailed their wings almost on the ground, as I have seen the ring plover do when alarmed on account of its young. This was generally if not always done as the bird was flying away from me. I felt satisfied they must have eggs or young, probably the latter, quite close at hand, and by watching closely the movements of the birds, they gradually gave me a clue to the spot, and I presently heard a feeble chirping like that of a young chicken. Even then it was difficult to find the right direction, and when I seemed to be absolutely close to them, I could not immediately discover them, so close did they lie, and so nearly resemble the surrounding stones. There were two, lying a few inches apart, not yet able to run, and I should judge hardly a day old, but I could find no eggshells anywhere near. They were beautiful little creatures, mottled with grey, and of course quite covered with down. The legs were leaden-coloured, and presented a decided contrast to the orange legs of the ring plover, of which

I had shortly before found a specimen, perhaps twelve or fourteen days old. Whilst examining this beautiful little pair I obtained some excellent views of their parents, which came as near as they dared venture. I found them more distinct in plumage from the ring plover than I had previously supposed. The male bird had a little piece of black on each side of the neck, but not meeting in front, and so not forming a ring of black round the neck, and consequently not giving the white above it any appearance of a ring as in the ring plover. The female appeared to want these two black markings on the neck altogether, and to be entirely white on the front of the neck and breast. The flight struck me as rather more irregular than that of the ring plover.

After leaving these birds, and walking a little further eastward along the beach, I was greatly pleased at coming upon a colony of lesser terns, another species that I had never seen before. The difference in size between them and the common tern was very noticeable as they flew overhead, and serves at once to identify them; the note was also totally distinct, and somewhat resembled the word "weet." There were, I think, about twelve or fifteen birds, and they kept nearly over one portion of the shingle where there was more grass growing among the stones than elsewhere. I searched long and carefully for their eggs, but in vain, and have no doubt it was a week or two too early.

Mr. J. B. Crosfield exhibited several large pieces of the decayed root of a Scotch fir, tunnelled and bored into in all directions by a number of the larvæ of a large beetle, stated by Mr. Edward Saunders to be *Prionus coriarius*. The portions of wood exhibited contained about six or eight of these grubs, some of which were almost 2in. long. The tree in which they were found was blown down in the grounds of Mrs. Wix, of Reigate, from whom the following letter was read, addressed to the Secretary:—

"Isbells, Reigate, 8th December, 1880.

"DEAR SIR,—

"According to promise I send you some of the larvæ of the beetle identified by Mr. Edward Saunders as the *Prionus coriarius*, and some of the root of the tree which they inhabited. The old Scotch fir was greatly disfigured by a heavy snowstorm followed by frost in January, 1866. From that time ivy was encouraged to cover it. It subsequently lost many branches and died, still standing with its mantle of ivy until the night of the 27th of last October, when it was uprooted and fell during a gale of wind and rain. It measured 44ft. in height, and between 8ft. and 9ft. in circumference. During the process of removal the roots were observed to be very much decayed and pulverised, and on examination nearly 100 of these grubs, large and small, were found in the various perforations, some of the tunnels reaching 2ft. or 3ft. up the trunk of the tree, but none in the pupa state. In one piece of wood you will find the creatures inhabiting the

cavities they have bored, and which I have numbered. The other piece of wood will show you their distinctive operations. If you would wish to keep any or all of these specimens of insect and wood, I hope you will do so, as I have several more alive and active. Trusting they may afford a subject of interest,

"I remain, yours truly obliged,

"JANE WIX."

Dulan 46

25 11. 81.



S. STRAKER & SONS, Printers, London and Redhill.

filed for the purpose of
banks.

[illegible]

A List of Fresh and Salt Water Diatoms found in Mud Banks in the River Thames, compiled for the purpose of showing the influence of the Flood and Ebb Tides in forming those Banks.

Marine Diatoms in small capitals. Fresh Water Diatoms in ordinary type.						Marine Diatoms in small capitals. Fresh Water Diatoms in ordinary type.						Marine Diatoms in small capitals. Fresh Water Diatoms in ordinary type.																		
	If 10 Miles above Teddington Lock.	T. Kingston Cut.	One Mile below Teddington Lock.	Key.	Blackwall.						Half a Mile above Teddington Lock.	Teddington Cut.	One Mile below Teddington Lock.	Key.	Blackwall.						Half a Mile above Teddington Lock.	Teddington Cut.	One Mile below Teddington Lock.	Key.	Blackwall.					
ACHNANTHES BREVIPE, Ag.						ISTHIA ENERVIS, Ehr.						PLEUROSIGMA ESTUARI, W. Sm.																		
ACHTINOCYCLUS SEDENARIUS, Reper.						Melosira varians, Ag.						" BALTICUM, W. Sm.																		
" UNDULATUS, Kütz.						" NUMAULOIDES, Kütz.						" LITTORALE, W. Sm.																		
" OCTODENARIUS, W. Sm.						Meridion circulare, Ag.						" HIPPOCAMPUS, W. Sm.																		
AMPHITEBAS AETHELIANA, Ehr.						Navicula Amphiboscens						" STRIGILUM, W. Sm.																		
Amphora ovalis, Kütz.						" cuspidata, Kütz.						" DISTORTUM, W. Sm.																		
" minutissima, W. Sm.						" ABUTTA, Gray.						" PODOBIRA HOMIOLDES, Kütz.																		
AMPHIPHORA ALATA, Kütz.						" HUMEROSA, De Breb.						RHADONEMA ARCUTUM, Kütz.																		
" VITREA, W. Sm.						" rhyacoccephala, Kütz.						Surirella biseriala, De Breb.																		
BIDDULPHIA AURITA, Breb.						" firma, Kütz.						" splendida, Kütz.																		
" RHOMBUS, W. Sm.						" ovalis, W. Sm.						" SERIATULA, Turp.																		
" TURGIDA, W. Sm.						" SMITHII, De Breb.						" GEMMA, Ehr.																		
" BAYLEII, W. Sm.						" JENNERII, W. Sm.						" PASTUOSA, Ehr.																		
" PULCHRELLA, Gray.						" affinis, Ehr.						" BRIGHTWELLII, W. Sm.																		
Camptodiscus costatus, W. Sm.						" tumida, W. Sm.						" linearis, W. Sm.																		
" CLYPEUS, Ehr.						" gibberula, Kütz.						" ovata, Kütz.																		
" CRIBROSUS, W. Sm.						" amphirhynchus, Ehr.						SCHIZONEMA CRUCIGER, W. Sm.																		
" BICOSATUS, W. Sm.						" ambigua, Ehr.						Staurois Pheniceorum, Ehr.																		
Cocconeis Pellicula, Ehr.						" SUBSALINA, Dunklin.						" gracilis, Ehr.																		
" Placentalis, Ehr.						" sphaerocarpa, Kütz.						" SALINA, W. Sm.																		
" SCUTELLUM, Ehr.						" PUNCTULATA (MARINA), W. Sm.						" scabra, W. Sm.																		
Cocconeis lanceolatum, Ehr.						" dicophala, Kütz.						" PULCHRELLA, W. Sm.																		
" Cistula, Ehr.						" DIDYMA, Kütz.						Synedra radians, W. Sm.																		
" cymbiformis, Ehr.						" ENTOMON, Ehr.						" olivacea, Ehr.																		
" parvum, W. Sm.						" INTERRUPTA, Kütz.						" obtusa, W. Sm.																		
Cocconeis minor, Ehr.						" LYRA, Ehr.						" capitata, Ehr.																		
" RADIATUS, Ehr.						" HENNELII, W. Sm.						" SALINA, W. Sm.																		
" ECCEVENSIS, Ehr.						" DOMBUS, Ehr.						" TABULATA, Kütz.																		
" OCELLUS IRIDIS						" CONVEXA, W. Sm.						Triblonella marginata																		
Cyclotella Kuetzingiana, Thier.						" CRABO, Ehr.						" PUNCTATA, W. Sm.																		
Cymbella Ehrenbergii, Kütz.						" rhomboides, Ehr.						" ACUMINATA, W. Sm.																		
" cuspidata, Kütz.						Nitzschia sigmoides, W. Sm.						" gracilis, W. Sm.																		
Cymatopleura Solea, W. Sm.						" curvula						" angustata, W. Sm.																		
" apiculata, W. Sm.						" amphioxys, W. Sm.						TRICERATIUM FAVOS, Ehr.																		
" elliptica, W. Sm.						" Brebissonii						" STRIOLATUM, Ehr.																		
Diatoma vulgare, Borg.						" SIGMA, W. Sm.						" ALTERNANS, Bail.																		
DORYPHORA AMPHICEROS, Kütz.						" DUBIA, W. Sm.																								
" DOEKII, W. Sm.						Odontidium mutabile, W. Sm.																								
Encyonema prostratum, Ralfs.						" Tabellaria, W. Sm.																								
" cuspidatum, Kütz.						Orthis arenaria, W. Sm.																								
Epithemia turgida, W. Sm.						" MARINA, W. Sm.																								
" ARGUS, W. Sm.						Pinnularia nitens, Ehr.																								
" CONSPICUA, W. Sm.						" major, W. Sm.																								
" GIBBA, Kütz.						" VIRIDA, W. Sm.																								
" AUSTULUS, Kütz.						" PERIGRINA, W. Sm.																								
" VENTRICOSA, Kütz.						" DISTANS, W. Sm.																								
EUPHODIUS ARGUS, Ehr.						" VIRIDULA, W. Sm.																								
" SCULPTUS, W. Sm.						" neolepta, Ehr.																								
" RADIATUS, Bail.						" oblonga, W. Sm.																								
Fragillaria capacea, Desm.						" radiosa, W. Sm.																								
" virescens, Ralfs.						" stauroisiformis, W. Sm.																								
Gomphonema constrictum, Ehr.						" gibba, Ehr.																								
" capitatum, Ehr.						" LIRIOS, Ehr.																								
" acuminatum, Ehr.						PLEUROSIGMA FASCIOLE, W. Sm.																								
" cristatum, Ralfs.						Pleurosigma attenuatum, W. Sm.																								
" olivaceum, Ehr.						" Spenceri, W. Sm.																								
" curvatum, Kütz.						" FORMOSUM, W. Sm.																								
" bichotomum, Kütz.						" QUADRATUM, W. Sm.																								
" MARINUM, W. Sm.						" ANGULATUM, W. Sm.																								

Half a Mile above Teddington Lock.

In Teddington Cut.

One Mile below Teddington Lock.

Between Richmond and Twickenham †

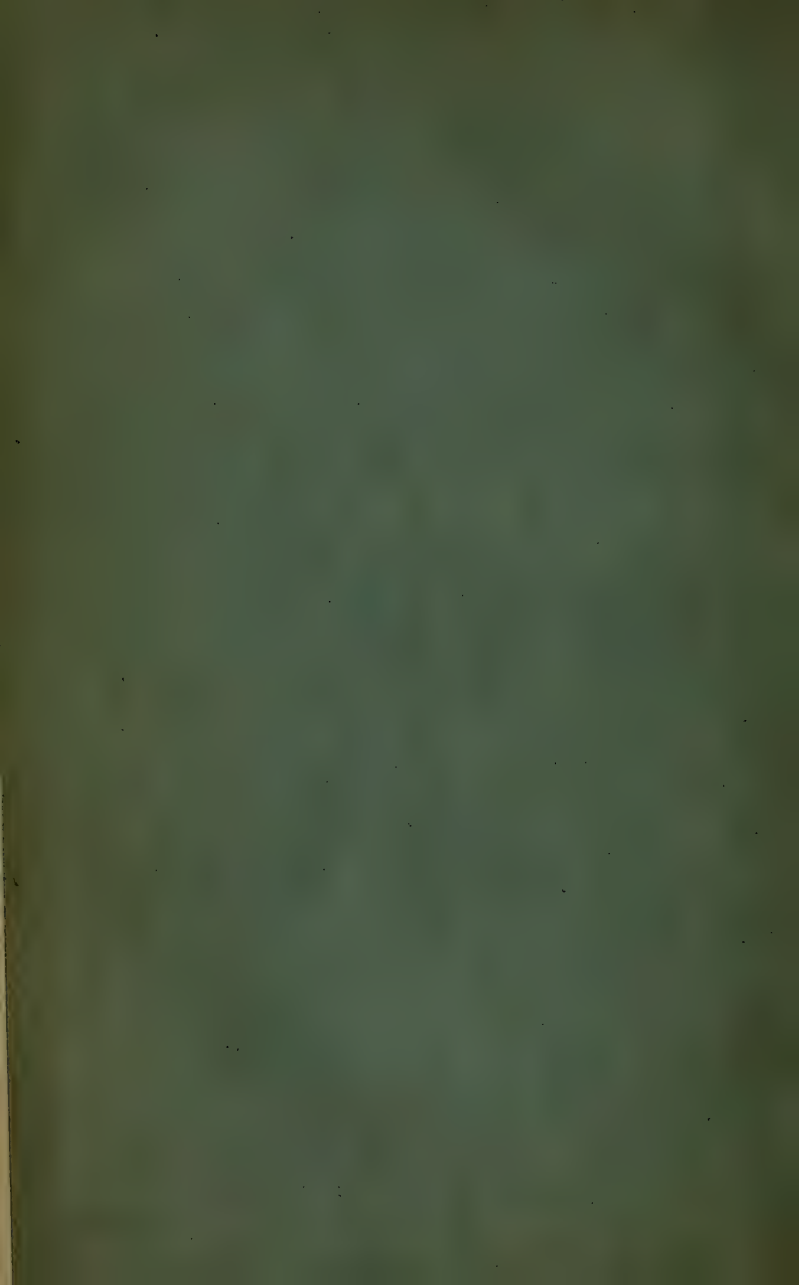
Key.

Blackwall.

Estuary of the Thames.

Ebb Tide runs →				← Flood Tide runs			
Fresh Water Diatoms.	66	33	54	48	52	39	9
SALT WATER DIATOMS.				17	37	45	60

† Collected after the above Table was completed.



23 DEC 1884

PROCEEDINGS

OF THE

HOLMESDALE NATURAL HISTORY CLUB

FOR THE YEARS 1881, 1882, 1883,

TOGETHER WITH

RULES, AND LIST OF MEMBERS.



LONDON:

PRINTED BY WEST, NEWMAN & Co., 54, HATTON GARDEN, E.C.

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Honorary Secretary:

ALBERT J. CROSFIELD, *Oxford Road, Redhill.*

PROCEEDINGS
OF THE
HOLMESDALE NATURAL HISTORY CLUB.

EVENING MEETING.—JANUARY 14TH, 1881.

A LECTURE, at which the public were present, was given by Mr. B. LOMAX, of the Museum, Brighton, entitled "Manners and Customs of the Flowers." After some prefatory remarks the lecturer went on to speak of the apparent intelligence of flowers, referring to instances in which, from the various ways in which they behave under varying circumstances, or even sometimes under similar circumstances, it might almost be supposed that they possess the power of reason. In the case of some English plants introduced into the Botanic Gardens at Melbourne considerable diversity of conduct was observable; some individuals flowered at the time at which they were accustomed to in England, through the Australian winter, and others adapted themselves at once to the changed seasons. The lecturer then spoke of the harmony of colours that often prevails amongst flowers that habitually grow in close proximity, such as the Dog-violet and Primrose; and he attributed this in part to the effects produced by the various rays of light as to heat, electricity, &c. He further spoke of the way in which plants are constantly regenerating the earth, and referred to the part performed by lichens and mosses after the death of a tree, in keeping its organic substance from going back to an inorganic state. He referred also to the modes of growth met with in different plants, some being of a zigzag character, others spiral, in which case it is often found that the leaves are so placed that five leaves

occur in two complete circles. In other plants, again, the leaves are arranged in whorls round the stem at regular intervals. In treating of the relations existing between plants and insects he pointed out that the pollen-grains contain grape-sugar, which the plant absorbs. The nectar thus stored attracts insects, which in their turn assist in the fertilization of the plant. He referred to the apparent faculty possessed by plants of developing different kinds of buds, almost as they please. In a state of high cultivation plants sometimes may be said to make mistakes—as, for instance, when a stamen becomes converted into a petal. The nitrogen found in plants, in starch, glucose, &c., may be said to be of no use to the plant itself, serving only to supply food for the support of animal life. Thus plants may be said to act as cooks in preparing inorganic matter for the use of animals. Plants will often readily accommodate themselves to changed circumstances; the Crab, the Sloe, and other plants that have been brought under cultivation afford remarkable instances of this. They resemble man not only in this capacity for adaptation, but in the whole course of their lives—their gradual growth to maturity, their decay, their liability to illness or disease and recovery from it when wisely treated, and in many other points of what may fairly be considered as their characters. Some of these characteristics in the exercise of which plants more or less resemble man were dwelt upon in detail by the lecturer.

EVENING MEETING.—FEBRUARY 11TH, 1881.

Mr. J. J. Gill read a paper, entitled ‘The Potato Disease,’ from which the following is extracted:—

Probably the Potato plant has always been subject to the ravages of particular kinds of fungus, and in this it in no wise differs from other members of the vegetable kingdom. That fungoid disease is no novelty is attested by the fact that geologists have discovered specimens of fossil vegetables which have evidently suffered from the ravages of fungus

and in some instances the fungus itself in a fossilised state may be detected by the microscope. The disease in question does not confine itself to the Potato, but readily spreads amongst other members of the same natural order, the *Solanaceæ*, such as the Tomato, which has suffered quite as much as the Potato, entire crops being often destroyed by the blight. It also attacks, but less destructively, our wild *Solaneæ*, as *Solanum Dulcamara*, &c. In their tropical haunts the *Solanaceæ*, including both Potatoes and Tomatoes, which are entirely exotic, have a hardier growth and a much stronger constitution; they consequently do not suffer so severely from disease as they do in the somewhat unnatural and artificial circumstances in which they find themselves with us. Our indigenous *Solaneæ*, as *Solanum Dulcamara*, *Hyoscyamus niger*, and *Atropa Belladonna*, are liable to be affected by the fungus; but, being hardy, they do not easily take it, and when affected readily throw off its effects. When Tomatoes are cultivated under glass, and maintained at a temperature and under conditions generally resembling those of their native habitats, they are not nearly so liable to disease as when exposed in the open air. The height of the fungus is often less than the thickness of the leaf on which it grows. This fungus always accompanies the disease, and the most competent authorities are agreed in considering it the cause of the disease itself. Its ramifications or roots bore their way into the substance of the leaf and other parts of the plant, the sprays finding egress at the stomata or breathing-holes on the surface.

To Mr. Worthington Smith, more perhaps than to anyone else, we owe the knowledge we now possess of this extraordinary fungus. This gentleman was engaged in examining the specimens sent to him, when suddenly he saw displayed within the field of his microscope the same transparent round bodies seen long before by Dr. Montague. There could be no doubt that they were indeed the resting-spores of the Potato-murrain, as they appeared in the tissues of the leaf itself, and not on the surface where they had hitherto been looked for; and each had germinated and sent

out a long transparent thread or tube, which had found its way out at the stomata of the leaf. One reason of its previous non-discovery was manifest, *viz.*, its close resemblance to the cells of the leaf, from which it could hardly be distinguished. Further observations, extending over a period of many months, confirmed Mr. Worthington Smith's discoveries, and it soon became an accepted fact that an important discovery had been made, and a great and important step had been taken in the direction of finding out the nature of this most destructive disease.

Since 1876 not much of importance has been done towards the further investigation of the *Peronospora infestans*. Multitudes of suggestions have been made as to the best way of getting rid of its inflictions, but hardly anything really feasible has ever yet been offered. Almost the only plan I can think of as at all likely to succeed in avoiding the presence of the enemy is to cultivate the earliest and perhaps the very latest varieties; by this means the crops would not be so much, if at all, exposed to danger during the critical period of late summer and early autumn, when the spores begin to germinate.

Dr. Bossey made some remarks on the subject of the paper, and called attention to the modes adopted for the prevention of the disease. He recommended the growth of Potatoes with thick smooth cuticle and short haulm as best calculated to resist the attacks. He also suggested that the resting-spores might be destroyed by chemical agents mixed with the soil.

Mr. Gill remarked that it is easy to destroy the specimens in a laboratory, but that the destructive agent, in order to be really of practical value, must be cheap, and easily applied.

Mr. Cheal mentioned that glasses covered with glycerine had been found to catch the spores when placed in other fields in the neighbourhood of that affected by the disease, thus showing how widely and abundantly the spores become disseminated. He stated that the Potato is a native of the uplands of Mexico, and grows in a moderately cool climate.

Dr. Bossey read a paper on 'The Hairs of Plants as

concerned in the Supply of Water and Nourishment,' as follows:—

For the sake of brevity my paper has been announced as one on the Hairs of Plants as concerned in the supply of water and nourishment; but I wish it to be understood that I include with hairs—villi, scales, down, ciliæ, and all other hair-like modifications of epidermic cells, and even the cells of the epidermis itself, only excepting such as are of a secreting or glandular character. Respecting these organs I have two propositions to maintain—first, that they absorb water, and secondly, that with this water food or nourishment is conveyed into the sap and tissues of the plant. Each of these propositions I shall endeavour to support by the results of experiments, by observations on living plants, and by reasoning from analogy.

Absorption of Water. — That rain and dew falling upon the green and superficial parts of plants were absorbed by them, and thus introduced into the sap, was long ago affirmed by Hales and Bonnet, but that such absorption took place was subsequently denied by DeCandolle, Mayen, and the generality of botanists; quite lately, however, and chiefly as the result of the investigations of the Rev. Mr. Henslow and Mr. Bousangault, the fact of this absorption has been received as fully established. In order to prove it experimentally, I place before you some seeds of the Wild Oat (*Avena fatua*). If exposed to moist air, rain, or dew, the spirally-twisted awn at the extremity of these seeds will immediately begin to uncoil itself, and the absorption of water is indicated by the rotation of the awn. The instantaneous coiling-up of the awn attached to the spores of *Equisetum arvense* when they are breathed upon or otherwise moistened affords proof of the great sensibility of plant-tissues to the presence of moisture, and the extreme rapidity with which it is absorbed. A third mode of experimentally demonstrating the same fact may be shown by immersing in a jar of water one limb of a forked branch of Lilac having leaves upon it, while the other limb with its leaves remains in the air outside the jar. The leaves on the branch in the air will be kept in a state of freshness

and turgescence *for some time* by the water which is taken up by the immersed branch. Other experimental proofs might be adduced to prove the absorption of water, but those I have adduced, with the following demonstrations of the same fact by living plants, will be sufficient.

It is well known that plants discharge a large amount of water into the air. This exhalation takes place in part through the cells of the epidermis, but chiefly through the stomata, or special organs provided for this purpose. The amount of this exhalation varies much in different plants, in different parts of the same plant, and in the same plant at different times. It is also greatly influenced by the number and distribution of the stomata, the thickness of the cuticle, the amount of chlorophyll in the leaf, the presence, intensity, and colour of the light, and the moisture or dryness of the soil in which the roots are placed. I mention the influence of these circumstances on the exhalation of water because they have a direct bearing on the amount of its absorption—one action being compensatory to the other. For instance, under the heat and light of a midsummer day the water exhaled by the leaves often exceeds that which is absorbed by the roots, and consequently the leaves lose their turgescence, become flaccid, and droop; but when a shower occurs or when dew falls in the evening these flaccid leaves, by recovering their wonted firmness and turgescence, show the effects, and afford a proof of the absorption of water. The same thing is proved by observing the condition of trees during the dry season in tropical climates. They are then destitute of leaves, but before any rain falls on the ground many of them burst into flower, when the prevalence of moisture-laden winds which precede the rainy season gives them the opportunity of absorbing water. Lastly, on this head I would wish you to observe the relation which seems to exist between the fibrillæ by which roots take up water from the earth and the hairs, scales, and other asperities by which leaves can obtain it from the air. Where one is largely developed the other is proportionately deficient. As we all know, some of our native plants have simple tap-roots, with

few fibrillæ; and many such plants grow on dry walls or in poor sand, whence they can obtain but little water or nourishment. All such plants, so far as I know them, have a large development of cuticular appendages, which seems specially designed to compensate for the deficiency of the root-action.

Some remarks in the 'American Monthly Microscopical Journal' for October, 1880, so exactly confirm this view that I cannot forbear quoting them. The writer (Mr. Merriman), after saying that the soil of South Florida is sandy and barren, that the atmosphere abounds in the elements of plant-growth, the winds being charged with moisture and bearing minute quantities of nitric acid and saline compounds, and the swamps furnishing abundance of salts of ammonia and carbonic acid, goes on to observe:—'To utilise these precious products from the air it is necessary for plants to have peculiar organs, such as absorbing glands, glandular hairs, stellate hairs, protecting scales, and a variety of other special appendages. All these are developed in remarkable profusion and perfection in the vegetation of Southern Florida. Although the meagre soil produces no nutritious grasses, and scarcely enough of an honest vegetation to keep a herbivorous animal from starving, yet there is an abundant flora, such as it is—air-plants, parasitic growths, insectivorous plants, and strange herbs seeking a livelihood in any other way than the good old honest one of growing from the roots.' Mr. Merriman adds—'We can scarcely examine the leaves or stems of any plant growing in Southern Florida without discovering some beautiful or striking modification of plant-hairs or scales, or glands, or other absorbing or secreting organ.' These facts and observations so fully prove that the hairs of plants absorb water and thus compensate for deficient root-action, and maintain that state of equilibrium between absorption and transpiration which is necessary for the well-being of every plant, that I think it almost unnecessary to support my position by reasoning from analogy. I will content myself with simply mentioning that root-hairs and hairs growing in the atmosphere are alike in being composed

of cellulose, that both are made up of cells, and that those parts of a plant which in the air produce epidermic hairs will in water or in the earth develop root-hairs or fibres by which that plant can be nourished.

The second proposition I have to maintain is, that food-nourishment or materials for supporting the growth of a plant may be absorbed by the epidermis, and by its cellular and hair-like extensions. The nourishment or plant-food thus taken up is of two kinds, general and special; the former or general consisting of carbonic acid and ammonia, as these are dissolved in the rain-water and dew which we have shown to be taken up by superficial parts of plants; the latter or special food consists of nitrogenous matter derived from insects and animalcules, or other living or dead animal matter. This kind of food is only taken in by a limited number of plants, called carnivorous or insectivorous. These plants are furnished with special organs for entrapping, decomposing, and absorbing their insect-food. The food is trapped in various ways. The Pitcher-plant is a well known and very perfect example of one, but I prefer to adduce some from the plants of our own neighbourhood. Take, for instance, the Sun-dew (*Drosera rotundifolia*) growing on Reigate Heath. Each leaf of this plant has above 100 hairs growing on its upper surface. These hairs vary in length, but they are so arranged that when curved inwards they form an arch over the middle of the leaf. They are endowed with great sensibility, and whenever a tiny insect alights upon them they first entangle it by a viscid secretion which exudes from the glandular head of the hair, and then take away all chance of its escape by bending inwards so as to carry it towards the middle of the leaf, where it is covered in the way I have described. When an insect is caught in this way the tentacles which surround it secrete a sort of gastric juice or digestive liquid, which dissolves the nitrogenous matter in the insect and fits it for the nourishment of the plant into tissues of which it is to be absorbed. Another kind of trap is seen in the Common Teasel (*Dipsacus sylvestris*). The leaves of this plant from opposite sides of the stem are so

connected together that a wide and deep funnel is formed by their union. This funnel is so constructed as to facilitate the entrance of insects, and yet effectually to prevent their escape; one part of it is smooth, and this slippery path leads down to a tank of water at its bottom, where the insects are drowned, while a set of hairs and spines pointing downwards effectually bar the way for ascent and escape. Other forms of traps occur in other plants. In *Pinguicula* the outer margin of the leaf folds backwards, and in *Utricularia* curious pockets with valvular openings are distributed over the floating roots to catch water-fleas, &c. Besides these traps, all known insectivorous plants have a curious set of glands or organs for the elaboration and absorption of their insect-food. These glands are well seen in the leaves of *Pinguicula*. They are circular in form, flat or dome-topped, composed of cellular tissue, divided into four or eight compartments, and containing protoplasm, with some small granules of chlorophyll. Their function seems to be to absorb and appropriate such parts of the entrapped insects as are fit for the food of the plant to which they belong.

In conclusion, I may mention that I consider the vast world of animalcular life as another source from which plants, especially such as are furnished with hairs, down, or other form of tangle, may derive a supply of nitrogenous food. The following quotation from Mr. Saville Kent's 'Manual of the Infusoria' (part 1, p. 140) now in course of publication first suggested this idea to my mind, and will, I think, convince you that this source of supply, though constituted as it is of the minutest of organised bodies, is by no means an insignificant one. "On October 10th, 1879, a day of intense fog, the author gathered grass saturated with dew from the Regent's Park Gardens, the Regent's Park, and the lawn of the Zoological Gardens, and submitted it to microscopical examination without the addition of any supplementary liquid-medium. In every drop of water examined, squeezed from the grass or obtained by its simple application to the glass slide, animalcules in their most active condition were found to be literally swarming, the material derived from each

of the several localities yielding, notwithstanding their close proximity, a considerable diversity of types." Mr. Kent then enumerates and names the several species found, but, as my object in making the quotation is simply to refer to these animalcules as a possible source of food to plants, what I have already quoted may be sufficient for my purpose.

Dr. Bossey exhibited, in illustration of his paper, a bud of Brussels Sprouts producing rootlets in water, spores of *Equisetum arvense*, glume of the Wild Oats, bladder of *Utricularia*, glands of *Pinguicula lusitanica*, and of an Australian *Pinguicula* with tentacles clasping a fly.

EVENING MEETING.—MARCH 11TH, 1881.

A large number of young persons, many of them belonging to some of the schools in the neighbourhood, were present by special invitation.

Mr. W. H. Tyndall, President of the Club, gave an address, entitled "The Hills and Valleys of Reigate, and what they are made of"; in the course of which he briefly enumerated and described the various geological formations found in this neighbourhood, giving various facts of interest about each.

Mr. J. B. Crosfield gave an address, entitled "A talk about Birds and their Eggs," and partially illustrated it by his collection of eggs, which he had brought for exhibition.

Microscopes were exhibited by Mr. Tyndall, Dr. Bossey, and Mr. J. B. Crosfield; and a number of collections and specimens belonging to various branches of Natural History were exhibited by Mr. Cooper, Mr. Edwin Ashby, Mr. Aspland, and other members of the Club.

EVENING MEETING.—APRIL 8TH, 1881.

Mr. W. C. Wallis, of Brighton, read a paper on 'British Glaciers.'

Mr. Tyndall presented a table of meteorological observations for the year 1880, and pointed out some of the special features connected with the weather of the year.

ANNUAL MEETING.—OCTOBER 14TH, 1881.

The Annual Report for the past year was read, and was as follows :—

HOLMESDALE NATURAL HISTORY CLUB.

Annual Report, Oct. 14th, 1881.

During the past year five new members and four subscribers have joined the Club, and six have left, *viz.*, one by death and five by resignation, the present membership being seventy-three.

The Evening Meetings were regularly held each month during the winter. The following is a list of the papers and addresses that were read or delivered :—

Nov. 12, 1880. An Address on 'Bones from the Peat and Shell-marl of the River Kennet,' by Mr. H. M. Wallis, of Reading.

Dec. 10. 'The Rivers of Surrey,' by Mr. W. H. Tyndall.

Dec. 10. 'A Visit to the Haunts of the Kentish Plover,' by Mr. J. B. Crosfield.

Jan. 14, 1881. A Lecture, entitled 'Manners and Customs of the Flowers,' by Mr. B. Lomax, of Brighton.

Feb. 11. 'The Potato Disease,' by Mr. J. J. Gill.

Feb. 11. 'The Hairs of Plants as concerned in the supply of Water and Nourishment,' by Dr. Bossey.

April 8. 'British Glaciers,' by Mr. W. C. Wallis, of Brighton.

On March 11th a very successful meeting was held, to which young persons residing or attending schools in this neighbourhood were freely invited, with the hope of inspiring an interest in Natural History. On this occasion addresses were given in a somewhat popular manner by the President of the Club (Mr. Tyndall), entitled 'The Hills and Valleys of Reigate, and what they are made of'; and by the Secretary (Mr. J. B. Crosfield), entitled 'A talk about Birds and their Eggs.' Microscopes and Natural History objects were also exhibited. The attendance was very large, and it is believed the meeting fully answered the purpose designed.

Mr. Tyndall furnished his usual table of meteorological

observations for the year 1880. One of the most striking features was the almost entire absence of very hot weather during the year, the only two days on which the thermometer marked as much as 80° being May 26th and September 4th.

OUTDOOR MEETINGS.—During the summer ten excursions have taken place, five of them occupying the whole day, and five the afternoon only. All the excursions that were planned were carried out, and the attendance of members at most of them was better than usual. The following is a list:—

Whole day.	Afternoon.
May 14. Edenbridge.	April 30. Betchworth Park and Brockham.
June 11. Penshurst.	May 28. Reigate Hill.
July 9. St. Leonard's Forest.	June 25. Box Hill.
Aug. 10. Gomshall, walking thence by the hills to Dorking.	July 23. Reigate Heath and Rice Bridge.
Sept. 17. Ashdown Forest.	Aug. 27. Nutfield Marsh.

April 30th.—In BETCHWORTH PARK the Wood Wren and Redstart were observed singing; the latter is not at all a common bird in our district. A young Brown Owl, apparently about three weeks old, was found at the foot of a tree, but the nest to which it belonged could not be discovered; it struck vigorously with its claws when touched, throwing itself partly on its back, as the habit of Owls is when fighting.

May 28. REIGATE HILL.—In the beech-wood several good specimens of the Bird's-nest Orchis (*Listera nidus-avis*) were found in flower; one of these was dug up, and the thick matted root, from which the plant derives its name, was well seen. *Epipactis grandiflora* was found in unusual abundance under the beeches, but only a few specimens were actually in flower at this date. *Veronica montana*, too, was found in some abundance, and also two specimens of *Habenaria bifolia*.

June 11. PENSURST. — Amongst the birds seen or heard in the park at Penshurst Place were the Green Woodpecker, Wild Duck, Coot, &c. A pair of Barn Owls also flew from the inside of the celebrated "Sidney Oak." The Nightingale

and Missel Thrush were heard singing, a somewhat late date for both species to be in song.

June 25. BOX HILL.—*Atropa Belladonna*, *Rhamnus catharticus*, &c., were found, and Bee Orchises were out in great abundance on the slopes of Box Hill. Sir J. Trevor Lawrence, Bart., M.P., very kindly permitted the party to visit his Orchid-houses, in which was a most interesting variety of Orchids of all kinds.

July 9. ST. LEONARD'S FOREST.—The High Brown Fritillary was found in great abundance; it seemed to affect almost exclusively the flowers of *Cnicus palustris*. A number of specimens of the Pearl-bordered Fritillary were also taken. Many extremely fine specimens of *Lastræa Oreopteris* were found; some fronds measured more than four feet in length. *Campanula hederacea* was found growing plentifully and vigorously in various parts of the Forest, and was not at all confined to places that were specially damp. *Anagallis tenella* and *Hypericum elodes* were also met with. In a field on the slope of one of the valleys or ravines in the more open part of the Forest, *Habenaria bifolia* was met with in greater profusion than any of the party had ever previously witnessed. There must have been many hundreds, if not thousands, of specimens in flower, but most of them had rather passed their prime.

July 23. REIGATE HEATH, &c.—A specimen of *Narthecium ossifraga** was gathered in flower in the marshy ground at the south-west corner of the Heath; this is a new though very likely locality for it. Other plants found were *Sedum Telephium* and *Rhamnus Frangula*. A specimen of *Prionus coriarius*, a Longicorn not at all common here, was taken in a wheat-field near the water-works.

Aug. 10. GOMSHALL.—The following are some of the plants found in flower:—*Epipactis latifolia*, *Inula Conyza*, *Linaria minor*; *Phyteuma orbiculare*, by no means a common plant hereabouts; *Campanula glomerata*, found in abundance in a locality of a few square yards in extent at the further side of

* It was afterwards ascertained that this plant had been introduced some years ago by Mr. N. E. Brown, of Kew.

Ranmore Common; *Epilobium angustifolium*, in profusion in a wood some distance west of Ranmore Common; the Wild Raspberry (*Rubus Idæus*) was growing in great abundance in many places on the top of the chalk-hills; the fruit was then ripe, and probably gallons might have been gathered. Several caterpillars of the Emperor Moth were found feeding on the leaves.

Aug. 27. NUTFIELD MARSH, &c.—*Malachium aquaticum* and *Bidens tripartita* were found in the wet ditches. *Chrysomela fastuosa*, an extremely beautiful little green and gold beetle, was found in great numbers on the flowers of *Galeopsis Tetrahit*, a plant that was there growing to an unusual size, and in great profusion. Sir George Macleay very kindly allowed the party to visit his grounds and greenhouses at Pendell Court, where was seen a great variety of very interesting plants.

Sept. 17. ASHDOWN FOREST. — *Campanula hederacea* was found growing in marshy places on the left of the road from Forest Row to Wych Cross.

Amongst the EXHIBITIONS and RECORDS of the year it should be recorded that Mr. A. Bennett exhibited specimens of *Chara stelligera*, a species new to this country, found by him in Filby Broad, Norfolk, in September, 1880.

BOTANICAL LECTURES.—During the winter a course of six lectures was given under the auspices of the Club, at the Warwick Hall, Redhill, by Mr. N. E. Brown, of Kew, who most kindly gave his useful assistance gratuitously; and the Committee feel that the best thanks of the Club are due to him for so doing. The lectures were well attended, and proved of much interest.

Signed on behalf of the Committee,
WM. HY. TYNDALL.

The Treasurer's statement of accounts duly audited was presented, and read and adopted. The following is the abstract of it:—

<i>Receipts.</i>			<i>Expenditure.</i>		
	£	s. d.		£	s. d.
Oct. 1880.					
Balance in hand	12	6 1	Rent of Museum, Gas, and		
1881.			Firing	16	1 0
Subscriptions	31	0 7	Assistant Curator, 2 years	13	0 0
Receipts from Lectures } Mr. N. E. Brown }	6	10 0	Attendance, cleaning, &c.	1	2 0
			Hire of Room	1	10 0
			Travelling Expenses	2	6 0
			Zoologist, Printing, Post- age, Collector's Commis- sion, and Sundries	5	11 0
			Balance in hand	10	6 8
	£49	16 8		£49	16 8

The following gentlemen were then elected as Officers of the Club for the ensuing year:—*President*, Mr. W. H. Tyndall; *Treasurer*, Mr. R. C. Baxter; *Secretary*, Mr. J. B. Crosfield; *Curator*, Mr. J. Linnell, jun.; *Members of Committee*, Dr. Bossey, Dr. Holman, Mr. C. Marshall, Mr. T. Cooper, Mr. A. Bennett, Mr. T. L. Aspland, Mr. A. J. Crosfield, Mr. A. C. Sterry, and Mr. J. J. Gill.

Mr. N. E. Brown presented to the Club 'A Review of the Ferns of Northern India,' in three parts, by Charles Baron Clarke, M.A., F.L.S. The thanks of the Club were voted to him for this donation.

Mr. N. E. Brown gave a short address on 'The Life-History of *Volvox globator*,' specimens of which he also exhibited under the microscope. He stated that the *Volvox* is a plant belonging to the fresh-water Algæ; under the microscope it is seen to be covered with very minute dots; these are the gonidia, and when highly magnified are found to be flask-shaped, terminating at the smaller end by a pair of cilia, which project through the outer wall of the *Volvox* into the water in which the plant lives, and are the means of imparting to it its revolving action. Some persons have asserted that this motion is round a regular axis, but Mr. Brown stated that his own observations did not confirm this. Two modes of reproduction occur: in the one case (the asexual mode) two of the gonidia unite and form a sort of disc, and the cilia springing from them disappear; they continue to grow, and finally the wall of the plant bursts and

they are ejected, according to the general statement, at one of the so-called poles; but Mr. Brown stated that he had observed this take place also at other points. The young plants are ejected sometimes to about 1-20th of an inch, and soon begin to move about. At first the gonidia are closely packed, and are consequently hexagonal in shape; when older they are more remote, but are still connected by minute strings of protoplasm. In the other mode of reproduction (the sexual) some of the gonidia become much enlarged, and a dark green mass appears in their centre, called the oogonium; another form also appears, called the antheridium, containing little cells closely packed, with small filaments attached. From these, little bodies escape, sometimes even penetrating the outer wall of the *Volvox*; when these come in contact with the oogonium they pierce it, producing fertilisation. During this process of reproduction the *Volvox* has an orange colour.

Mr. Brown gave some description of the Fresh-water Medusa (*Limnocoodium Sowerbii*), recently discovered by Mr. Sowerby, and described by Prof. Ray Lancaster, first found in the tank at the Botanical Gardens, in the Regent's Park.

Mr. Linnell exhibited a specimen of *Prionus coriarius*, a longicorn beetle not common in this neighbourhood. It was taken by him on the top of an ear of wheat in a field near the Reigate Water-works on July 23rd, on the occasion of the Club Excursion to Rice Bridge.

Mr. Cooper exhibited a specimen of *Galeopsis versicolor*, gathered near Redstone Manor House, a plant of which only one previous record has been made in this district.

Mr. Edwin Ashby exhibited the following Lepidoptera, taken during the past summer:—*Adippe*, *Selene*, and *Lonicera*, taken at St. Leonard's Forest on the occasion of the Club Excursion on July 9th; *Ægon*, taken in Tilgate Forest; *Albicillata*, reared from eggs laid by a female taken at Bridge Road, Redhill; *Prunaria* and *Advenaria*, taken at the end of June in Fir-woods on the Leith Hill range; the latter was driven from its food-plant, *Vaccinium Myrtillus* (the Whortleberry); *Hectus*, found flying in quantities at sunset, in July,

along a short stretch of hedge below the western end of Park Hill; *Orion*, taken at sugar in the New Forest the third week in June; *Quadra*, reared from larva found feeding on beech-lichens, third week in June.

Mr. J. B. Crosfield read the following paper, entitled 'Notes on the Breeding of the Lesser Tern,' and exhibited two eggs of that species:—

I have not collected many specimens during the past summer that would have any special interest to the Club, but I bring for exhibition two specimens of the eggs of the Lesser Tern, which I obtained near Dungeness. In a paper which I read last winter at one of our meetings on the subject of the Kentish Plover, I alluded to a colony of Lesser Terns which I observed on May 29th, 1880, evidently breeding, although on that occasion I failed to find any of their eggs. On June 14th last, therefore, my brother-in-law and myself went to Rye for the purpose of searching for the eggs of this bird, and becoming, if possible, better acquainted with its habits. A walk of several miles eastward along the shore brought us to the spot, and we soon found that the Lesser Terns still frequented the same portion of shingle where we had seen them last year; and from the persistent way in which they kept over the same place, constantly uttering their cry, a sound resembling the word 'weet' or 'peet' pronounced rather short, it was tolerably clear to us that they had eggs or young, we thought probably the former, and had accordingly timed our visit about a fortnight later than last year, as we concluded we were then too early. There were six or eight pairs of Lesser Terns, and also about three pairs of the Common Tern flying about amongst them. The shingle here was nearly level, being rather further inland than the beach proper, and there was a very thin growth of grass in parts, forming very broad bands or ridges, the intervening space between these bands being bare shingle. After searching up and down these grassy portions most minutely for several hours, all that we discovered was a Common Tern's nest containing one addled egg, and with two young birds close by on the shingle. Failing in this

way, we then decided to watch the birds very carefully, and see if any of them would betray their nests. I retired behind a heap of shingle, and my brother-in-law lay down behind a large log that was lying on the beach in another direction. I soon saw two birds settle, and when they rose I walked to the place and almost immediately saw—lying on the shingle in a slight depression or irregularity of the surface, without the vestige of a nest—two eggs and a young bird. The latter was evidently only just hatched, and the eggs were on the point of hatching, as both were chipped and the young birds were chirping audibly inside. Presently after I found at a very little distance the two eggs of the other bird I had watched, just in the place I expected, also laid on the shingle without any nest. Meanwhile my brother-in-law had marked another bird settle some twenty or thirty yards off, and very soon found three eggs; and I afterwards found two young ones recently hatched near the same place. Our mistake had been in searching on the grassy portions of the shingle, for all the four nests we found were on the part where it was absolutely bare of any vegetation. We had also expected to find some little material employed, but in none of those we found was any material whatever used, and there was in no case any artificially formed depression for the eggs to lie in. During the whole time of our search the birds were flying about overhead, and we had excellent opportunities of observing their quick graceful flight, almost Swallow-like in its manner, the birds themselves also being not much larger than Swifts. We noticed that, besides their ordinary cry, they sometimes uttered a sort of cackling note, shorter than the other, and repeated several times.

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EVENING MEETING.—NOVEMBER 11TH, 1881.

The President read an address introductory to the winter series of meetings, on the subject of the study of Natural History, of which the following is his summary:—

Summing up the remarks made as to the mode of acquiring

information on subjects of Natural History, they may be shortly stated under the following seven heads:—(1) Observe closely. (2) Record accurately and fully. (3) Begin with the first principles of a subject. (4) Obtain a good knowledge of the general outline. (5) As opportunity offers, fill in the details. (6) Study principally one branch of knowledge at a time. (7) Have a clear perception of what has been studied before attempting what is more difficult.

Mr. A. J. Crosfield read a paper, entitled 'Notes on the Spring Flora of Mentone,' from which the following are extracts:—

The Department of the Alpes Maritimes in which Mentone is situated contains one of the richest floras in France. The land rises from the sea-level to a height of over 5000 feet, so the floral regions may be divided into the seaboard, the hill-country, and the Alpine ranges, each with a tolerably distinctive flora. The whole flora of France includes about 4000 species, whilst nearly 2500 have been recorded in the region of the Alpes Maritimes. Of 128 species which I recorded as found in flower between April 9th and 25th, 1874, only 54 find a place in the British Flora. Of these 15 are either rare as British species or stand in the 'London Catalogue' as 'introduced'; and only 36 find a place in the 'Flora of Reigate.' It will be observed, however, that the comparison made rests upon very limited statistics, and twelve months' notes might yield very different results. When we come to examine the 74 species which are not British, we find amongst them 19 species which are very closely allied to British species. Of our 46 British Ferns all but 16 figure in the flora of the Alpes Maritimes. Wherever there is a damp hollow, whether in wall or rock, the Maiden-hair (*Adiantum Capillus-Veneris*) grows; and in deep cavernous recesses where water constantly drips its fronds may be found a foot or more in length. *Ceterach officinarum* is abundant on the walls. Amongst the rocks on the higher hills *Asplenium fontanum* is widely distributed; a rarer fern is *Cheilanthes odora*, which formerly grew at Rocabruna, but has, I fear, been well-nigh exterminated from that locality

by visitors. Amongst the 54 British plants noted at Mentone are representatives of 27 Natural Orders; 6 species belong to *Leguminiferæ*; 4 each to *Boraginaceæ* and *Labiata*; and 3 each to *Scrophulariaceæ*, *Crucifera*, and *Orchidaceæ*.

Mr. A. J. Crosfield exhibited dried specimens of a large number of the plants referred to in his paper.

He also gave some account of the birds he had observed in the neighbourhood of Mentone, including the Serin Finch, Citril Finch, Woodchat Shrike, Blue-headed Wagtail, Pied Flycatcher, Black Redstart, Cliff Swallow, Common Redstart, Nightingale, Wryneck, Blackcap, Russet Wheatear, and others.

EVENING MEETING.—DECEMBER 9TH, 1881.

Mrs. T. L. Aspland exhibited a specimen of *Camelina sativa*, gathered by herself by the side of a road below Reigate Hill. This is a species new to our immediate district, though recorded as met with in several localities in the 'Flora of Surrey.'

Mr. J. B. Crosfield exhibited specimens of a number of wild flowers gathered by him within the past week, accompanied by a list, showing fifty-three species met with in flower since the commencement of December, including *Anthyllis vulneraria*, *Helianthemum vulgare*, *Viola odorata*, *Carduus acanthoides*, *Cnicus palustris*, &c.

Mr. W. M. Webb exhibited some very perfect specimens of Palæolithic flint implements—arrow-heads, needles, &c., found some years ago in Mr. Trower's fields at Redhill.

Mr. J. J. Gill exhibited portions of a Roman tessellated pavement from Walton Heath, which he described as being in a very perfect condition. It was about a yard below the surface of the ground.

Mr. T. Cooper read a paper on 'The Genus *Mesembryanthemum*,' and brought a large number of growing specimens to illustrate the subject. He stated that the species are mostly perennial, a few are annual, and fewer still are biennial. DeCandolle enumerates 316 species. Mr. Cooper

believes that twice that number may yet be added. The *Mesembryanthema* flower in all seasons of the year. They are mostly natives of S. Africa; a few are found in S. Europe, N. Africa, China, Chili, Peru, and the South Sea Islands. They all delight in sunshine, and require its stimulating influence to enable them to expand their flowers. He described a great many species.

Mr. Henry Boyle, M.A., of Clapham, read some notes and made remarks upon them, entitled 'Some Experiences in Natural History.' These related chiefly to entomological facts that had come under his observation at various times. In reference to the Emperor Moth he related that some years ago, when he used to rear insects of this species, he used to hang out the female moths in some rose-trees near the house, and after an interval of about half an hour the males were almost always attracted to the spot, although the nearest locality where they were ordinarily met with was a common at a distance of half a mile. He referred to the Oak Egger and to the poisonous nature of the small hairs used in the construction of its cocoon, and told how he had once inadvertently put a cocoon of this species to his lips, which became greatly swollen in consequence of the irritation produced by these minute hairs. He also mentioned that he had some years ago taken the rare *Gasteropaca* from a cocoon on a tuft of heather near Rugeley. Mr. Boyle also referred at some length to the subject of mimicry, and alluded to the resemblance that some of the Hawk Moth caterpillars when at rest bear to rolled-up leaves, the stripes on the sides of the body resembling the ribs of a leaf, and the horn somewhat resembling a stalk. The Puss Moth caterpillar when at rest was an instance of this; but when in any way irritated its appearance was very different, and he thought that the really hideous aspect of the insect under such circumstances might possibly serve as a means of protection to it, by tending to instil terror in its enemies. Other insects specially referred to by Mr. Boyle were the Unicorn Hawk Moth and the Fox Moth. He noted that the caterpillar of the latter is differently marked at two different

ages. Mr. Boyle related that he had successfully grown the *Victoria regia* out of doors through the winter at Ambleside, in a small piece of water which he kept artificially heated to a temperature of about 65° Fahr., at only trifling expense.

EVENING MEETING.—JANUARY 13TH, 1882.

The President exhibited two specimens of rock, given to him by Mr. Shaw, Secretary of the South Eastern Railway Company, which had been taken from the excavations for the Channel Tunnel, Dover, as an illustration of the strata through which the borings are being carried.

Mr. J. B. Crosfield read a paper, entitled 'Ornithology in Wray Park,' as follows:—

I propose in the following paper to give a brief account of the birds observed at various times in the grounds of 'The Dingle,' in the Wray Park district, Reigate; not that the species noticed in that comparatively small area are in any respect different from those to be met with in the surrounding neighbourhood, nor yet because they include any of special rarity; but simply because I think such an account will serve to illustrate how many kinds we may reasonably look for within a limited area in this neighbourhood when the place is favourable for them; and also because it may be in some respects advantageous to record more full particulars respecting a small area rather than less complete ones relating to a larger extent of country. The area to which the following observations refer consists of about fourteen acres, and includes nearly equal extents of wood and field, the remainder consisting of garden. The soil of the greater portion is the Lower Greensand, but a small part towards the north-east is on the Gault. The wood contains some trees of good size, and consists chiefly of Beech, Ash, Oak, Elm, Spruce and Scotch Fir, tolerably well distributed. The only water is a small artificial pond in the garden, with the exception of a stream resulting from the surface-drainage of

higher ground, which flows through the wood after periods of rain. Being situated at the edge of the more inhabited parts of Reigate, it is evident that many of the species frequenting more open or retired country can hardly be expected to occur; thus birds of prey are but rarely seen, and the waders and swimming birds are almost wholly absent. I will now proceed to enumerate the species in order, referring to such facts as I have observed about each, as may seem worth mention:—

Kestrel.—Only very occasionally seen flying over.

Sparrowhawk. — Seen now and then, but only at rare intervals.

Barn Owl. — Only very seldom seen; more often heard after dark.

Brown Owl.—In the spring of 1880 one was frequently heard hooting in the wood, nearly always in the same locality; but I could never succeed in seeing it, and I do not think it was breeding there.

Red-backed Shrike. — We only see this bird here very seldom, and not at all in most summers. I think they probably bred somewhere very near in 1872.

Spotted Flycatcher.—An extremely common species from about May 8th till September, when it leaves us. In 1880 I saw a single bird as late as October 10th. The earliest date I have recorded for its arrival is May 2nd, in 1869; and in 1868 it had an egg by May 16th. For many years it used to build on the stump of a small branch against the trunk of an Elm standing close to a path along which persons were frequently passing, and used to desert its nest very easily. I saw a curious instance of the habit this species has of pursuing insects on the wing on July 2nd last. A Yellow Underwing was in my bedroom flying up and down against the window, when a Flycatcher came and hovered outside, within about nine inches of it, and appeared each moment as if on the point of dashing at the moth through the glass. It followed its movements up and down, poising itself all the time on its wings and keeping at about the same distance, until at some slight movement I made it flew away. On one

occasion I found a nest of this bird containing as many as seven eggs.

Missel Thrush. — One or two pairs generally breed with us every year. I generally hear their song first in January, or, if the season be severe, not until the beginning of February; but in mild seasons they may sometimes be heard in December.

Song Thrush. — This species has seemed to me to be a little diminished in numbers since the severe weather of the last three winters. The earliest date I have recorded for its eggs is March 7th; but on February 21st, 1869, I saw one sitting on its nest in a high Fir-tree, so it probably then had eggs.

Blackbird. — Equally common with the preceding, and nearly as early a breeder. The dates I have recorded for the commencement of its song vary between February 2nd and March 13th. This bird and the Thrush are great berry-eaters. They usually strip the Mountain Ash trees of their berries almost as soon as they are ripe, and are also very fond of *Berberis* and yew berries. I once saw a Blackbird bolt seven yew berries consecutively, without appearing to crush them in the least. I have also seen them devouring the berries of the Portugal Laurel; and in spring, when the Ivy-berries are ripe, they come in very opportunely for them. One day last spring I noticed a quantity of small hard seeds of a peculiar shape on the edge of a Blackbird's nest in which were young birds just ready to fly; on examining the seeds I found they were those of Ivy-berries, and therefore concluded that the birds had been feeding their young on this kind of food.

Fieldfare. — Only seldom seen, and then only flying over.

Redwing. — This species frequently visits us chiefly in severe or snowy weather, when they like to get into sheltered places on the banks of the wood near the stream, and scratch among the leaves. The earliest date I have recorded for their appearance in autumn is October 6th.

Hedge Sparrow. — Abundant all the year. It generally begins its song early in January, unless the weather be severe.

This bird if disturbed at night will, as I have often noticed, break out into a few notes of its song, but almost instantly relapses into silence—possibly singing in its sleep. I have also often heard the Lesser Whitethroat do the same.

Robin. — Very plentiful; it sings more constantly than any other species, but is generally almost entirely silent from about the end of June to the end of July. Last April a pair nested in an old tin oil-can which someone had placed on its side on the branch of a tree; the nest just filled the can. This bird often begins to build in February.

Redstart. — This bird is only a very occasional visitor; I have most often seen it in August, and have observed it feeding on the *Berberis* berries.

Grasshopper Warbler. — I think I have on one occasion heard this bird's note, but cannot be quite positive.

Nightingale. — Some years ago we used to have two or three pairs of this species, and they used to nest frequently; but latterly they seem to have withdrawn further away, and we have usually only one bird singing in our grounds, and even it seems usually to nest beyond our limits. My recorded dates of arrival vary between April 11th and 24th.

Blackcap. — Arrives usually about April 7th; earliest record March 23rd, latest April 21st. In 1867 we had as many as five nests with eggs at the same time. This species has a decided predilection for berries; and will eat Ivy berries in spring, and *Berberis* berries and red currants in summer.

Garden Warbler. — I see or hear this bird perhaps in most years, but can hardly consider it one of our residents; I only have once known it nest with us, *viz.*, in 1870.

Whitethroat. — More plentiful just outside on the narrow strip of Wray Common than actually within our borders; but yet it sometimes nests with us.

Lesser Whitethroat. — A regular visitor to us every summer; my earliest recorded date of arrival is April 14th, but the more usual date is about April 23rd. It generally builds in a small Hawthorn-hedge, but the nest is such a slight structure that it may readily be overlooked.

Wood Wren. — Generally appears about April 28th; earliest record is April 23rd. It generally builds on one of the banks in the wood among a thick growth of Mercury, Hyacinths, &c. I once watched one of these birds engaged in building, and saw it visit the nest forty times at intervals of half a minute on the average. I believe it was every time the female, as I could hear a male—doubtless the one belonging to this nest—singing at a short distance all the time. I have certainly seen both the male Long-tailed Tit and Wren assist in building.

Willow Wren. — Arrives about April 8th, and usually builds on the ground amongst thick herbage, the domed nest appearing very little raised above the general level.

Chiffchaff. — The first summer migrant to appear, generally the last week in March, but often still earlier; once heard—*viz.*, in 1872—as early as March 7th. Its loud double chirp is usually repeated about ten to twelve times consecutively. Its nest is often just a little raised above the ground, in a bramble or other low bush.

Goldcrest. — Met with all the year round, but we do not find its nest by any means every year. I have found it in Spruce Fir, *Deodara*, and *Abies Douglasii*.

Great Tit. — A very common species, and generally making its presence known by its varied notes, the best of which, begun very early in the year, might almost be called a song. It sometimes selects curious sites for its nest: once at some depth down an old piece of iron water-pipe; another time under a large inverted flower-pot, when it must have entered through the hole.

Blue Tit. — Also common; many seasons a pair nested in a hole in a Laburnum; in other years this hole has been tenanted by Marsh Tits and Cole Tits.

Cole Tit. — Somewhat less common, but to be seen at all times of year. I have often noticed this and the two last-named species eating the beech-mast in the autumn; they hold a nut on a branch under one foot, and pick out the kernel bit by bit with the beak. Chaffinches, which also feed on the mast, generally do so on the ground, and without

holding it; whereas the Nuthatch, on the other hand, carries one of the nuts to a tree and places it in a crevice of the bark, and then picks out the inside.

Marsh Tit. — Rather less common than the Cole Tit.

Long-tailed Tit. — In most years a pair have nested with us, sometimes in a small thorn-hedge, sometimes in a bush, sometimes in the fork of a tree, and once suspended among the twigs near the extremity of a branch of a tall Spruce Fir, high above the ground. I once found them building as early as March 29th.

Pied Wagtail. — Occasionally breeds, but by no means a resident species.

Grey Wagtail. — Seen now and then by the pond, or flying over in autumn or winter.

Meadow Pipit or Titlark. — Sometimes seen in the field, but not very common.

Tree Pipit. — Visits us in some summers, but not regularly; and has not been known to breed here.

Sky Lark. — Common, but probably only one or two pairs nest in our fields; the nest is sometimes found when the grass is mown.

Wood Lark. — The only occasion when I have seen this bird for certain was on February 18th, 1877, when I watched one for some time walking about on the lawn, and had an excellent view of it through a telescope.

Common Bunting. — I have occasionally heard its harsh song or chirp.

Yellowhammer. — Only occasionally seen.

Chaffinch. — Very common, especially in autumn; most numerous when there is an abundant crop of beech-mast. During spring this bird sings incessantly; I have observed it repeat its song fifty-two times in seven minutes.

Brambling. — In January and February, 1869, and in November and December, 1871, we had considerable numbers in the wood; they associated a good deal with Chaffinches, the species they seem most to resemble.

House Sparrow. — As common here as elsewhere, though perhaps not nesting quite so plentifully with us.

Greenfinch. — Very common. They seem rather specially fond of the seeds of the Maple, and also eat the berries of the *Cotoneaster* and the *Cratægus Pyracantha*, or perhaps it may be only the stones that they care for.

Hawfinch. — A tolerably common bird with us, and much more often to be seen of late years. It often breeds with us, several times at a considerable height in one particular Hornbeam, and once only about nine feet from the ground, in a Beech close to a path where persons were frequently passing immediately under the nest, although it was well concealed by some tufts of leaves.

Goldfinch. — A pair built in a Laurel in 1858, but did not rear their young; I believe the only subsequent occasion on which I have seen any here was a small flock in October, 1868.

Linnet. — Tolerably common at times, but at others much less so; I do not think it always breeds.

Lesser Redpole. — I have a record of seeing a pair in February, 1868, but am not sure of any other instance.

Bullfinch. — We have generally several pairs about. They seem very partial to the seeds of the Ash-tree in autumn and winter. As spring comes on they fancy the buds, and I think especially like to pick at the flower-buds of the Elms, which come out some time before the leaves.

Crossbill. — The gardener observed some in July, 1868, and in November of the same year my brother saw several. One of them appeared to be feeding on seeds of the *Arbor Vitæ*.

Starling.—Very common.

Crow.—Only seen on a very few occasions.

Rook. — Very common. In two or three years a single nest has been built in one or other of our trees, but has always been deserted. Rooks breed plentifully in Sir A. Watson's grounds just at the other side of the railway.

Jackdaw. — Common as a visitor, but has never been known to breed.

Jay.—Only quite an occasional visitor.

Green Woodpecker. — Visits our wood or garden now and then, but is more readily heard than seen. On July 3rd last I watched one for some time on the lawn apparently feeding, probably on ants, of which I found some afterwards at the place.

Lesser Spotted Woodpecker. — A not unfrequent visitor, and much more often observed than the last-mentioned. The remarkable vibrating sound, almost to be called creaking, that is produced by the very rapid strokes of its beak on a tree, when once heard is always afterwards recognisable. It is about the same size as the Nuthatch, but it is remarkable how very different they are in their movements in a tree, both as to climbing, striking at a bough, and in other points.

Wryneck. — Arrives usually about April 14th, and no doubt breeds most years with us, though we do not always know of its nest. It has bred in a hole in an Ash, which in other years has been occupied by Nuthatches, Blue Tits, and Starlings.

Creeper. — I think we generally have but one pair. The nest is one of the smallest internally of any that I know, and is sometimes placed in rather curious situations.

Wren. — Very common. Wrens seem to have a habit of sometimes beginning a nest very early in the year (I once found one begun as early as February 4th), and leaving it perhaps only half-finished for a month or two, and ultimately completing and using it.

Nuthatch. — We have one pair constantly resident, and they breed regularly; and I think have made use of most of the available holes one year or another, always plastering some clay round the entrance, even when it seems so small as to render the process unnecessary. In a large Elm-tree, where they one year occupied a hole, I have found at one time or another nine different kinds of nests with eggs, *viz.*, Flycatcher, Missel Thrush, Song Thrush, Blackbird, Robin, Greenfinch, Starling, Wren, and Nuthatch.

Cuckoo. — Visits us every summer, but I doubt if it often lays in our grounds. In 1868 an egg was found in a Hedge-sparrow's nest on May 23rd, and another in another Hedge-sparrow's nest in the same hedge on June 13th, probably laid by the same bird.

Kingfisher. — Pays visits not unfrequently to the small pond in our garden, where it has often been seen to catch Goldfish or Carp.

Swallow. — Common throughout summer, but only seldom breeds.

Martin. — Several pairs breed regularly under the eaves. I think the latest date of their stay in autumn that I have recorded is November 19th, but I have once or twice seen one later than this outside our limits.

Sand Martin. — Often seen flying round; their nearest breeding place is about half a mile away.

Swift. — Very common from about May 1st to about August 26th; does not breed with us.

Nightjar. — This species ought hardly to be included, as I have not seen it, but only heard it from our grounds.

Wood Pigeon. — Very common, and breeds on the tops of tall inaccessible Scotch Firs till very late in the autumn. A nest was blown down in the gale of October 14th last, and I saw pieces of the egg-shells lying beneath the tree. Probably its early and late breeding has something to do with the great increase of numbers everywhere.

Stock Dove. — I have once or twice been almost sure I have seen this species, but have never been quite certain.

Turtle Dove. — Comes to our wood every year, but we have never found the nest, so I am doubtful if it breeds.

Pheasant. — A very occasional visitor.

Partridge. — Ditto.

Woodcock. — Has been seen a few times, but I have never seen it myself.

Heron. — Now and then seen flying over.

Corn Crake. — Only heard from our grounds at some distance.

Waterhen. — Seen on a few occasions feeding in the field or on the lawn.

Wild Duck. — Seen occasionally flying over.

Wild Goose. — Once or twice seen flying over in a flock at some height; species uncertain.

Besides the foregoing, I have on various occasions heard birds calling overhead at night, and have thought I have recognised the notes of Golden Plover, Curlew, Dunlin, and perhaps other species; but, as I do not feel sufficiently sure

of these, I do not include them in my list. I have thus recorded the occurrence of seventy-six species of birds, of which three are, however, insufficiently identified; of the seventy-three certain species, forty-five may be considered as residents or frequent visitors, and twenty-eight as quite irregular and uncertain in their appearance. I append a list showing the number of pairs of each species which in my opinion probably breed here each year, and which may accordingly be considered as the residents. This is of course only an estimate, and is arrived at not solely by reckoning the number of nests known of at any one time, but also by forming an opinion as to the number of individual birds; estimated partly by noticing the particular localities they chiefly frequent, and partly by the number that are to be heard singing. As of course the number of a good many of the species varies somewhat from year to year, I have endeavoured as far as possible to state what I think to be an average of a series of years:—

	Pairs.		Pairs.
Spotted Flycatcher.	4	Marsh Tit.	1
Missel Thrush	2	Long-tailed Tit.	1
Song Thrush.	10	Sky Lark.	1
Blackbird.	10	House Sparrow.	8
Hedgesparrow	7	Chaffinch.	6
Robin	9	Linnet.	1
Nightingale	1	Greenfinch	4
Blackcap	4	Hawfinch.	1
Lesser Whitethroat	2	Bullfinch	2
Wood Wren	2	Starling	4
Willow Wren	5	Wryneck	1
Chiffchaff.	4	Creeper.	1
Goldcrest	1	Wren	5
Great Tit.	3	Nuthatch.	1
Blue Tit	3	Martin.	4
Cole Tit	2	Wood Pigeon	4

Total = 114 pairs of birds of 32 species.

Mr. W. H. Tyndall presented the accompanying statistical table of the Meteorology of the year 1881, as recorded by him at Oxford Road, Redhill, and also read some Notes relating to the Meteorology of the year, as follows:—

The south-westerly gales which blow in autumn and winter usually increase in violence after sunset, and diminish in force after sunrise, so that unless an observer has a self-registering barometer he is not always able to record the greatest depression. The north-east gales which blow in spring, and sometimes in the winter, with great violence appear not to be under the same law. These gales, especially in spring, are usually stronger in the day, and diminish in force towards the night and during the night. There is also a difference in the character of the S.W. and N.E. gales, independently of the difference in temperature. The S.W. gales blow in gusts at tolerably even intervals, each gust gradually increasing in force and as gradually decreasing. The N.E. gales are for the most part steadier in force, the gusts are of longer duration, and do not exceed the general force of the wind to the same degree as the S.W. gusts exceed the general force of the gale. The origin of these gusty winds from the S.W. is not very clearly ascertained, but it is believed they arise from the influence of the Gulf Stream, the warm waters of which raise the temperature of the air over the Stream very considerably; and this warm stratum of air coming into contact with the cold air over the ocean on each side of the Gulf Stream creates sudden and violent squalls, which find their way to Western Europe in the peculiar gusts of the S.W. winds.

The coldest day observed by me during 1881 was on the 16th of January, when the thermometer sank to 5° , or 27° below freezing. The warmest day was on July 4th, when I recorded 90° . I think, however, it must have ranged higher; I had workmen about the house, and they moved the thermometer to look at it and disarranged the register. The thermometer reached 89.5° on July 15th, and 87° on the 19th. The temperature was over 80° on twelve days during July, and once in June, thirteen days in all, compared with only two days in 1880. On eight consecutive days, from July 12th to 19th, it reached over 80° , the average of the eight days being nearly 84° . As regards cold, the temperature fell to 32° and under on ninety-nine days in the year, as

compared with ninety days in 1880, February and March in 1881 being colder than the corresponding months in 1880. During the months of June to September no frost was observed. During thirteen days in January the temperature did not rise at any period of the day above freezing, continuously from the 12th to the 22nd, and again on the 24th and 25th. Those were the only days in the year during which the temperature did not rise above freezing. There were three cold days towards the end of February,—the 21st, 22nd, and 23rd,—in which the maximum was 35° , or 3° above freezing. Upon the average the temperature of the year was less than that of 1880, being 46.96° in 1881, as compared with 48.36° for 1880.

Rain fell on 182 days in 1881, and on 180 days in 1880. It is surprising how little is the variation year by year in the number of days' rain. The number of days each month may differ greatly from the number in corresponding months of other years, but from January to December the total is pretty much the same every year, being about half the number of days. This does not mean that half the days are wet days, but that some amount of rain more or less falls upon an average about 180 days in the year. The amount of rain year by year may and often does vary considerably. Comparing the rain in 1881 with that in 1880, as regards the months, in February and in December in each year about the same quantity fell in the corresponding month, about $3\frac{1}{4}$ in. in February, and about $3\frac{2}{3}$ in. in December. The greatest difference was in August, when 4.60 in. fell in 1881, but only .83 in. in 1880; but in October the relation was reversed, only 2.74 in. fell in 1881, but 7.48 in. in 1880. As regards heavy falls of rain, only once in 1881 more than one inch fell in the twenty-four hours from 8 a.m. to 8 a.m.; that was on October 22nd; but in 1880 there were three falls of above an inch, *viz.*, on July 29th, 1.22 in.; on September 11th, 1.29 in.; and on October 9th, 1.53 in. There were, however, in 1881 six occasions on which from 8-10ths to 9-10ths of an inch fell, *viz.*, on January 18th, which was snow, June 17th, July 31st, August 25th, November 26th,

and December 17th. The longest period without rain in 1881 was fifteen days from March 27th to April 10th, and the longest period of continuous rainy days (not of course of continuous rain) was from September 17th to 28th, twelve days.

The year has been remarkable for heavy gales; that on January 18th, about which some remarks will be offered, and again on October 13th and 14th, and November 26th to 28th. The gale on January 18th from N.E. was remarkable for the heavy fall of snow which accompanied it. The average fall at Redhill and the neighbourhood was over eight inches, but it drifted in many places to as many feet. Usually in this part of the kingdom snow falls at a temperature somewhere about the freezing-point; when the temperature is above the freezing-point the snow falls in large flakes, and is in its character more dense; when snow falls at a temperature considerably below the freezing-point it has the character of fine dust. This was the case on January 18th; the temperature was very low, falling to 20° in the night, and never rising above 30° . The cold froze the snow hard, in small grains having about the hardness of sand, but not its density, and the strength of the wind prevented the particles of snow from forming flakes; the consequence was that the snow readily drifted, lodging in the deep lanes and railway-cuttings, and being piled up in places where it was sheltered from scattering by the wind. The snow found its way under tiles and slates, in at the sides of windows, doors and keyholes, and through inconceivably small crevices where the wind blew it. It is remarkable that this snow-storm was heavier in the south of England than in the midland and northern counties; and in the Isle of Wight, where snow rarely lies for twenty-four hours, it was perhaps heavier than in any other point. The gale of October 13th and 14th was from the S.W. I have already referred to the difference in character between the S.W. and N.E. winds. The heavy gales from S.W. are accompanied by high temperature in the autumn. The most disastrous effects of this gale were felt on the eastern coast."

METEOROLOGY. — OXFORD ROAD, REDHILL, SURREY (1881).

Month.	BAROMETER.				THERMOMETER.							RAIN.	
	Max.	Date.	Min.	Date.	Max.	Date.	Min.	Date.	Average.		Mean.	Total of Month.	No. of Days ·01 fell.
									Max.	Min.			
Jan. .	30·52	7	28·98	29	47·0	30 & 31	5·0	16	35·81	23·37	29·59	1·55	9
Feb. .	30·22	24	28·98	11	50·5	3	20·5	28	42·11	23·61	32·86	3·25	17
March	30·19	18	29·33	14 & 24	58·0	7	19·0	1	50·14	32·38	41·24	2·32	11
April .	30·22	28	29·75	22	68·0	13	26·0	20	54·03	35·70	44·87	·78	7
May. .	30·63	8	29·55	16	75·0	31	26·0	3	62·97	40·74	51·85	1·49	14
June .	30·35	30	29·49	6	80·0	4	35·0	8	68·41	46·77	57·59	2·25	11
July .	30·37	14	29·60	26	90·0	5	38·0	27	75·73	52·11	63·73	2·13	14
Aug. .	30·36	4	29·50	17 & 26	79·5	5	40·0	27	67·71	48·66	58·19	4·60	21
Sept. .	30·39	29	29·51	21	69·5	18	34·5	29	63·32	46·25	54·78	2·97	21
Oct. .	30·46	7	29·17	14	62·0	11	26·0	31	51·08	36·03	45·01	2·74	19
Nov. .	30·40	14	29·04	26	61·0	5	27·0	29	53·17	40·20	46·68	4·13	21
Dec. .	30·58	27	28·97	20	54·0	2	23·0	21	43·00	31·39	37·19	3·66	17
Year.	30·63		28·97		90·0		5·0				46·96	31·87	182

EVENING MEETING.—FEBRUARY 10TH, 1882.

Dr. Bossey exhibited under the microscope specimens of *Valisneria*, showing the circulation.

Mr. Henry Boyle, of Clapham, gave an address in continuation of that given at the meeting in December, narrating some of his experiences in Natural History. Mr. Boyle described the manner in which he tried, but in vain, to induce Swallows to build on his house. He prepared nests for them, and, climbing up at night to their own nests, took the birds out and placed them in the new ones he had made for them, on one occasion finding six old birds in one nest; but all his efforts were fruitless. On making a new pond in his garden, he sent to a dealer in Seven Dials for some fish, and he received by rail a consignment of 112, all alive and well. In addition to these he had a number brought over from Grasmere Lake. Some of these he noticed had turned black in transit, and on examining them closely he found that each of them had been blinded either from the jolting of the conveyance or from their dashing wildly about and injuring their eyes against the sides. Mr. Boyle supposed that, finding all dark around them, they assumed the black colour to correspond with their supposed surroundings. This led Mr. Boyle to speak of the change of colour that he had observed Green Trout from a Welsh lake to undergo when dying. He also alluded to the small size of Mountain Trout, and fish from mountain streams generally; and he said he had tried again and again to feed them up and increase their size in his own ponds and streams, but was forced to the conclusion that they were a naturally small variety. He next alluded to the trouble he in common with other possessors of fish-ponds had experienced with the rapid and prolific growth of American weed. It threatened at first quite to spoil his pond, and he expected to be compelled either to abandon it altogether or annually to drain off the water, and at great trouble and expense dig up the roots of the troublesome weed, as so many have had to do year after year. However, he decided to leave it alone awhile and see

what would happen, the result being that in the following year the weed was far less abundant and soon almost died out. This he ascribed to its having exhausted all the nutriment from the soil of the particular kind it required; whereas if he had dug over the ground he would not have got out all the roots, and those left in the ground would have a supply of fresh soil over them, which would impart new vigour to them and perpetuate the nuisance from year to year. He then alluded to the growth of several species of aquatic plants—*Sagittarias*, *Hottonia palustris*, *Nymphæas*, &c. He described the resting tubers of the *Sagittarias*, and the manner in which he had induced the *Hottonia* to grow in a stream in his garden. He had some Minnows introduced into his tank for stove aquatics, for the purpose of eating up the worms, and he frequently noticed the fish suddenly turn over on their sides and sink. As the number of his Minnows rapidly decreased, he watched closely and soon found that the strange behaviour of the fish was caused by a quantity of *Dytiscus* in the tank; these creatures seized the Minnows, who turned over to try and escape as they were being dragged down by their enemies. He also related how he kept a number of Axylotls from Mexico in a tank in his greenhouse, and he caused some amusement by his description of the adventures of an unfortunate Axylotl which had strayed from home and fallen into the clutches of the cat, which latter animal had succeeded in partially disembowelling it. Mr. Boyle replaced the protruding parts and sewed up the body again, and shortly after the Axylotl appeared as lively as ever, and none the worse for its escapade. The curious Mud-fish were also described, and the story related as to how the gardeners of a scientific gentleman of Mr. Boyle's acquaintance caused his Mud-fish mysteriously to disappear, as they declared they could not bear the look of their eyes. Mr. Boyle lastly exhibited specimens and drawings of the Lattice plant, a native of Madagascar introduced into this country by Mr. Ellis, the missionary. This plant is very difficult to grow, and requires to be planted in running water. Mr. Boyle has grown it very successfully, and has several times supplied the

gardens at Kew with fresh specimens to replace those they have lost.

EVENING MEETING.—MARCH 10TH, 1882.

Invitations to attend this meeting had been specially given to young persons attending schools or residing in the neighbourhood, and a large number were present.

Mr. H. M. Wallis, of Reading, gave an address, entitled 'Primeval Life in Britain.' In this he briefly traced back the history of man through the various stages of his civilisation to the Neolithic and finally the Palæolithic period, and gave some explanations as to the mode of making the implements used in those ages, and the various purposes for which they were employed; and made also some reference to the animals then existing in Britain.

Mr. J. J. Gill then gave an address, entitled 'Buttercups and Daisies,' in which he explained the functions and arrangement of the various parts of the flowers, and pointed out in what way natural selection had probably tended to operate in developing the various forms of leaf, &c., as now existing.

Mr. A. J. Crosfield then gave an address, entitled 'Our British Finches,' and also exhibited specimens of the eggs of several species of them. Amongst the species occasionally but not very commonly to be found in this neighbourhood he specified the Brambling, Siskin, and Lesser Redpole. He also gave some interesting information respecting many of the commoner species.

Several microscopes were afterwards exhibited by members of the Club; and a considerable number of collections and specimens of Natural History, as well as some other objects, were also shown, amongst which the following may be mentioned:—Skulls of Bushmen, Mr. T. Cooper; specimens of rock from the borings of the Channel Tunnel, Mr. Tyndall; a collection illustrating the geological strata of this district, Mr. W. Gilford; a series of eggs of the Common Guillemot, Mr. H. Crosfield.

EVENING MEETING.—APRIL 21st, 1882.

Mr. John Flower, of Croydon, President of the Croydon Microscopical and Natural History Society, gave an address on 'The Tertiary Beds at Park Hill, Croydon.' Mr. Flower illustrated his address with a large number of specimens of the various formations found in the cutting, including many fossils.

Mr. W. H. Summers, of Dorking, exhibited specimens of a considerable number of rare plants obtained by him in that neighbourhood, and made explanatory remarks upon them. He also presented the following list of localities observed by him for rare plants, chiefly in the neighbourhood of Dorking, but some of them in other parts of Surrey. Most of these localities are unrecorded in Brewer's 'Flora of Surrey,' and many of the plants are additions to the list of plants occurring in this district; and two of them, viz., *Rhinanthus major* and *Sedum reflexum*, var. *albescens*, are new to the county. (The numbers given refer to the pages in Brewer's 'Flora of Surrey,' and the letters to the districts into which the county is divided in that work).

11. *Chelidonium majus*. H. Occurs with double blossoms at Milton Street.
11. *Corydalis claviculata*. H. Milton Heath.
13. *Coronopus didyma*. G. Frequent in waste ground at the east side of Dorking, but never permanent.
14. *C. Ruellii*. H. Waste ground about Dorking, not common.
15. *Teesdalia nudicaulis*. H. Milton Heath.
17. *Alyssum calycinum*. E. Plentiful, in 1877, in a Clover-field at the foot of Denbies.
22. *Nasturtium amphibium*. G. Mole, near Castle Mill.
26. *Sinapis muralis*. H. By the railway-station, Dorking.
19. *Arabis hirsuta*. E. By the road from Dorking to Ranmore Common.
28. *Viola palustris*. H. Redland Woods.
33. *Polygala calcarea*. F. Denbies.
36. *Silene anglica*. G. Field at Trashurst, near Dorking.—H. Field close by Evershed's Rough, Abinger.
36. *S. noctiflora*. D. Fields about Croham Hurst, Croydon.
39. *Arenaria leptoclados*. H. Not infrequent in this district.
43. *Linum angustifolium*. E. At the foot of the Ranmore Hills.
47. *Hypericum montanum*. H. Roadside between Wotton & Westcott.
54. *Rhamnus Frangula*. G. Holmwood Common.

56. *Genista tinctoria*. G. Near Newdigate.
58. *Medicago maculata*. G. Cotmandene, near Dorking.
60. *Trifolium scabrum*. G. Cotmandene.
61. *T. striatum*. H. Abundant on the Holloway Estate, Dorking, when the new roads were made, a few years ago.
64. *Ornithopus perpusillus*. H. Milton Heath.
66. *Vicia tetrasperma*. H. Occurs frequently in this district.
69. *Prunus domestica*. E. On the chalk-hills near Dorking.
73. *Rubus idæus*. E. Picket's Hole (on the Ranmore Hills).
78. *Rosa spinosissima*. D. Duppas Hill, near Croydon.
90. *Claytonia perfoliata*. H. Abundant in a lane at Bury Hill.
91. *Ribes rubrum*. H. Brook-side near Westcott (now extinct).
93. *Sedum reflexum*. G. Roadside near Betchworth. — *Var. albescens* (Babington). H. Lane near Milton Heath; bank at Bury Hill.
94. *Saxifraga granulata*. H. Sparingly on Milton Heath; railway-cutting near Gomshall; Evershed's Rough. — D. Railway-cutting at Croydon.
97. *Conium maculatum*. E. Box Hill; Juniper Hill, near Mickleham.
99. *Sison amomum*. H. Plentiful in lane leading from Dorking to Leith Hill.
106. *Torilis nodosa*. D. In a corn-field near Croydon.
111. *Galium tricorné*. E. Fields at the foot of Denbies.
113. *Valeriana dioica*. H. Gomshall.
116. *Helminthia echioides*. H. Frequent in several localities near Dorking.
117. *Picris hieracioides*. E. Chalk-hills near Dorking.
121. *Hieracium vulgatum*. E. Denbies, near the great chalk-pit.
122. *H. umbellatum*. G. Glory Wood, near Dorking.
123. *H. boreale*. H. Westcott.
128. *Carduus pratensis*. C. Near the North Camp Station on the Reading line (just within the county boundary).
132. *Gnaphalium sylvaticum*. E. Box Hill.
135. *Erigeron canadensis*. G. H. Waste ground, Dorking, not constant.
140. *Anthemis nobilis*. E. Ranmore Common.
147. *Monotropa hypopitys*. E. Woods near Ranmore Common.
149. *Vinca minor*. H. Lane leading from Holmwood to Redland Hill.
150. *V. major*. H. Coldharbour Lane, Dorking (escape from cultivation).
151. *Erythraea pulchella*. E. At the foot of the Ranmore Hills, sparingly.
154. *Cuscuta trifolii*. H. Clover-fields near Wotton.
160. *Veronica montana*. H. Redland Hill.
161. *Rhinanthus major* (Babington). E. Roadside between Dorking and Westhumble (single plant).
165. *Linaria Elatine*. H. In a corn-field south of Dorking.
167. *Orobanche major*. H. Near Broadmoor, on Broom.
170. *Verbena officinalis*. H. Seen at one spot in this district, near Dorking.
173. *Mentha Pulegium*. G. Holmwood Common.

178. *Lamium incisum*. H. Milton Heath.
 180. *Nepeta Cataria*. H. Milton Heath (now extinct).
 181. *Prunella vulgaris*. E. Occurs with pink blossoms between Leatherhead and Headley (rather plentifully).
 182. *Scutellaria minor*. G. Holmwood Common; wood near Newdigate.
 194. *Chenopodium polyspermum*. C. Lane between Thorpe and Chertsey.
 195. *C. rubrum*. H. In a lane near Flint Hill, Dorking.
 197. *C. glaucum*. E. Once found near Cowslip Cottage, Mickleham.
 197. *C. Bonus-Henricus*. H. Abinger Hammer.
 198. *Polygonum bistorta*. H. Dorking Mill-pond.
 205. *Euphorbia platyphylla*. H. Westcott.
 221. *Neottia nidus-avis*. H. Redland Wood.
 222. *Epipactis latifolia*. E. Ranmore Common; Denbies; Bagden Hill, Bookham (where the flowers are very richly coloured).
 224. *Orchis Morio*. H. Meadows near Redland Wood; Bury Hill Park.
 227. *Habenaria bifolia*. G. Holmwood Common (two plants).
 227. *H. chlorantha*. E. Copses near Ranmore Common.
 228. *Herminium monorchis*. E. Ranmore Common.
 230. *Ophrys muscifera*. E. Ranmore Common; Ashdown Copse; Denbies.
 234. *Allium ursinum*. H. Redland Wood; copse near Westcott.
 237. *Convallaria majalis*. H. Bury Hill (very seldom flowering).
 239. *Anacharis alsinastrium*. H. Dorking Mill-pond.
 273. *Setaria viridis*. H. Near Westcott in 1880, rather plentifully (none seen this year).
 277. *Apera spica-venti*. H. In several fields round Dorking and Westcott.
 281. *Trisetum flavescens*. H. Not infrequent in this district, especially the part nearest the chalk range.
 282. *Triodia decumbens*. H. Bury Hill; near Logmore.
 286. *Poa nemoralis*. E. Denbies (in one spot). — H. On a bank close to the Catholic Chapel at Dorking.
 287. *Festuca pseudo-myurus*. H. In a sandy field at Dorking.
 299. *Lastrea dilatata*. E. Ranmore Common (sparingly).
 301. *Asplenium Ruta-muraria*. H. Old walls at Sutton and Felday.
 301. *Scolopendrium vulgare*. E. Ranmore Common (sparingly). In spite of Mr. Mill's testimony as to District H, I have only seen it there in one spot (a wall at Coldharbour).
 306. *Pilularia globulifera*. C. I believe this plant abounds in Virginia Water.

The foregoing list records thirty-one additional species for District H, four for District D, six for District E, and five for District G. Mr. Summers also recorded the following plants, met with since the above list was compiled, *viz.* :—

- Iris foetidissima*. E. In a copse on the Polesden Estate, bordering on Ranmore Common.
Petasites vulgaris. H. In a damp meadow near the South Eastern Station, Dorking.

He also mentioned that *Helleborus viridis*, *H. fetida*, and *Lathræa squamaria* are in great profusion this year in the localities given for them in the 'Flora.'

ANNUAL MEETING.—OCTOBER 20TH, 1882.

The Annual Report was presented and read, and was as follows :—

HOLMESDALE NATURAL HISTORY CLUB.

Annual Report, October 20th, 1882.

Since the date of the last Annual Report seven new members and seven subscribers have been elected into the Club, and nine have resigned, several of them on account of having left the neighbourhood, leaving a present membership of seventy-eight.

At the Evening Meetings, held monthly during the winter from October to April, the following papers were read or addresses given :—

- Oct. 14, 1881. 'The Life-History of *Volvox globator*,' by Mr. N. E. Brown (Kew).
- Oct. 14. 'A Description of the Fresh-water Medusa, *Limnocoedium Sowerbii*,' by Mr. N. E. Brown (Kew).
- Oct. 14. 'Notes on the Breeding of the Lesser Tern,' by Mr. J. B. Crosfield.
- Nov. 11. 'Presidential Address,' by the President, Mr. W. H. Tyndall.
- Nov. 11. 'Notes on the Spring Flora of Mentone,' by Mr. A. J. Crosfield.
- Dec. 9. 'The Genus *Mesembryanthemum*,' by Mr. T. Cooper.
- Dec. 9. 'Some Experiences in Natural History,' by Mr. Henry Boyle (Clapham).
- Jan. 13, 1882. 'Ornithology in Wray Park,' by Mr. J. B. Crosfield.
- Jan. 13. 'Notes on the Meteorology of 1881,' by Mr. W. H. Tyndall.
- Feb. 10. 'Further Natural History Experiences,' by Mr. Henry Boyle (Clapham).

- Mar. 10. 'Primeval Life in Britain,' by Mr. H. M. Wallis (Reading).
 Mar. 10. 'Buttercups and Daisies,' by Mr. J. J. Gill.
 Mar. 10. 'Our British Finches,' by Mr. A. J. Crosfield.
 April 21. 'The Tertiary Beds at Park Hill, Croydon,' by Mr. John Flower (Croydon).
 April 21. 'Notes on Rare Plants found in Surrey,' by Mr. W. H. Summers (Dorking).

The three brief addresses given on March 10th were on the occasion of a meeting to which the pupils at the schools and other young persons in the neighbourhood were specially invited; there was a large attendance of these, and they appeared thoroughly to appreciate the meeting, the interest of which was increased by the exhibition of many objects of Natural History by members of the Club.

OUTDOOR MEETINGS.—The following eleven excursions have taken place during the past summer:—

Whole day.

- April 22. Caterham Junction, Riddlesdown, Sanderstead, and Croydon, visiting the new railway-cutting between Woodside and South Croydon.
 May 20. Crowborough.
 June 17. The Silent Pool, near Gomshall, returning by Black Down to Chilworth.
 July 22. Botley Hill.
 Aug. 26. Ewhurst Mill.
 Sept. 23. Tilgate Forest.

Afternoon.

- May 6. Flanchford and Sidlow.
 June 3. Chaldon and Farthing Down.
 July 8. Norbury Park.
 Aug. 12. Godstone, visiting the white sand caves and the stone-quarries.
 Sept. 9. Bletchingley and Nutfield Marsh.

The plan was adopted this year of appointing beforehand a conductor for each excursion, which certainly conduced to their success, as in many instances the conductor had taken

the trouble to go over the ground beforehand, and thus knew better some of the objects that were to be met with and the best route to take. Botany is the branch that has on the whole received most attention at the outdoor meetings; less seems to have been done in Entomology than usual. A separate report of the excursions will be read at one of the meetings of the Club, so that it is not necessary to give so many details respecting them in the Annual Report as usual.

DONATIONS, &c.—‘A Review of the Ferns of Northern India,’ in three parts, by Charles Baron Clarke, M.A., F.L.S., presented by Mr. N. E. Brown, of Kew. The head of a Caribou from New Brunswick, presented by Mr. Thomas Hughes, of Wallfield, Reigate. A collection of plants, nine books published by the Ray Society; and a series of forty-nine plates illustrating Cuvier’s ‘Règne Animal,’ presented by Dr. Power.

EXHIBITIONS, RECORDS, &c. — The following Lepidoptera were exhibited by Mr. Edwin Ashby, taken by him in our district:—*Adippe*, *Selene*, and *Lonicera*, from St. Leonard’s Forest; *Ægon*, from Tilgate Forest; *Albicillata*, reared from eggs laid by a female taken at Redhill; *Prunaria* and *Adventaria*, from Fir-woods on the Leith Hill range, the latter on its food-plant, the Whortleberry; *Hectus*, from the west end of the Park Hill, Reigate.

BOTANY.—*Galeopsis versicolor* was exhibited by Mr. Cooper; the specimen was found at Redstone Hill; this species has only once before been recorded in this district. *Camelina sativa*, exhibited by Mrs. T. L. Aspland, gathered by her in a road below Reigate Hill; this species is new to our immediate district, though several localities in other parts of the county are named in the ‘Flora of Surrey.’ The following species new to the district have been recorded by Mr. W. H. Summers, of Dorking, who has also furnished the Club with a long list of new localities for species already recorded, the result of some years’ careful observation and work:—*Medicago maculata* and *Trifolium scabrum*, found near Cotmandene, Dorking; *Claytonia perfoliata*, in a lane at Bury Hill; *Sedum reflexum*, var. *albescens*, in a lane near Milton Heath, and at Bury Hill; *Rhinanthus major*, a single specimen found by the

roadside between Dorking and Westhumble; *Chenopodium glaucum*, one specimen found at Mickleham; *Apera Spicaventi*, fields near Dorking and Westcott. Mr. A. J. Crosfield has found *Lathyrus hirsutus* and *Vicia lutea* in a field at Nutfield, where they must doubtless have been introduced with seed; he also met with the former in the locality near Warlingham, just outside our district.

METEOROLOGY.—Mr. Tyndall presented his usual tables and notes for the past year, 1881, which were of more than ordinary interest, owing to the occurrence of the tremendous snow-storm of January 18th, and gale of October 14th; and the very low temperatures recorded in January, and intense heat in July.

The Treasurer's Balance Sheet for the past year, duly audited, was presented and read, as follows:—

Receipts.				Expenditure.			
	£	s.	d.	£	s.	d.	
Balance in hand, October, 1881	10	6	8	Cheque-book.....	0	2	1
Subscriptions received—				Rent of Museum, and Gas (1 year to June 30, 1882)	16	2	2
Collector	18	15	0	'Zoologist,' 9 months....	0	9	0
Treasurer	4	16	0	Mrs. Joyes (cleaning, &c., to Dec., 1881)	1	2	0
			23	Collector's Expenses, Postage, and Stationery....	0	3	0
Donations towards cost of printing 'Proceedings'			3	Collector's Commission ..	0	18	9
Sale of copies of 'Proceedings'			1	Mr. Cooper (salary for attendance at Museum) ..	6	10	0
Balance due to Treasurer.	0	14	1	Straker & Sons (for printing 'Proceedings')	14	14	9
	£40	1	9		£40	1	9

Special subscriptions since received, £3. 14 Members' and Subscribers' contributions due but unpaid, £5 10s. 0d.

Examined with the vouchers and found correct, } Wm. Hy. Tyndall.
October 19th, 1882 } F. Bossey.

The following gentlemen were then elected as the Officers of the Club for the ensuing year:—*President*, Mr. W. H. Tyndall; *Treasurer*, Mr. R. C. Baxter; *Secretary*, Mr. J. J. Gill; *Curator*, Mr. J. Linnell; *Committee*, Dr. Bossey, Mr. T. Cooper, Mr. C. Marshall, Mr. A. J. Crosfield, Mr. T. L. Aspland, Mr. A. C. Sterry, Mr. J. B. Crosfield, Mr. T. P. Newman, and Mr. H. W. Gilbert.

Mr. J. B. Crosfield read the following notes on the occurrence of a Goosander at Gatton Lake, by Mr. J. H. Gurney, jun., Northrepps, Norwich :—

“ On February 26th, 1881, a Goosander in female plumage was seen on Gatton Lake. I am sure it had not been there long, as I had been down several times. Small flocks of this bird are very apt to stick to a piece of water when it suits them, and are voracious fishermen. This bird remained nearly two months, and no attempt was made to shoot it. It was generally swimming in the water, sometimes with the Coots, which had come back after the breaking of the hard weather; but more often alone, and once it was noticed sitting happily on a tussock of reeds, which had probably been beaten down by the Swans. When frightened it would fly several times round the lake, and settle again on the further side. Its agility in diving was very great, but I never saw it bring up anything.”

The head of a Caribou from New Brunswick, well mounted, presented to the Club by Mr. Thomas Hughes, Wallfield, Reigate, was exhibited. A letter accompanying it stated that the Deer was killed during the autumn of 1881, and is fully matured, being between five and six years old.

Mr. A. J. Crosfield exhibited specimens of the following rare plants which he had collected during the past summer :—*Gallinsoga parviflora*, a South American plant belonging to the natural order *Compositæ*, which has become naturalised in the neighbourhood of Kew, where it is found in abundance; *Cicendia filiformis*, found at Tilgate Forest on the occasion of the Club Excursion there on September 23rd; *Campanula persicifolia*, a specimen of this rare plant was found by Mr. A. J. Crosfield growing on the north-east side of Box Hill, where *Teucrium Botrys* grows; *Verbascum lychnitis*, found near Sanderstead; *Orobis tuberosus*, var. *tenuifolius*, from the Addington Hills, Croydon; *Lathyrus hirsutus* and *Vicia lutea*, both found growing in abundance in a fallow field between the Fuller's-earth pits and Nutfield Marsh. As there had previously been crops of Clover and Italian Rye-grass in this field, doubtless these two plants, both of which are hitherto

unrecorded in our district, must have been introduced with seed. Mr. Crosfield also stated that he had found *Lathyrus hirsutus* growing in the locality recorded in the 'Flora of Surrey,' on Hallelew Farm, near Caterham. In most of the specimens observed by him there was but one flower on each peduncle, instead of two as given in botanical works. He also mentioned having observed *Ornithogalum nutans* this year still growing in the locality in the lane at Redhill.

Dr. Bossey exhibited specimens of the fungus *Hypoxylon concentricum*, found growing on burnt Furze-bushes near Ewhurst Mill on the occasion of the Club Excursion there on August 26th. He also showed sections mounted by him for the microscope, and a drawing of one of the sections as seen under the microscope. He stated that he had found another species of *Hypoxylon* growing on pea-sticks in his garden.

Mr. A. C. Sterry exhibited a drawing of a small Cuttlefish, which he could not at present identify, found by Miss Sterry at Deal, on a chain-cable that was taken up out of the sea; he had kept it alive several days, but had been unable to preserve it after it died. It had a power of squirting out a dark fluid in self-defence, similar to that possessed by other Cuttlefish.*

Mr. A. J. Crosfield read a paper on 'Plants of the Natural Order *Leguminifera*.'

* The above was submitted to W. R. Hughes, Esq., who says:—"It appears to be a *Chatopodus* (annelid, probably of the genus *Terebella*). The extensive thread-like tentacles, the body of few segments, and the tufted, shrub-like gills, all point to this. This kind of worm usually inhabits a tube composed of sand, small stones, or shell-fragments. It is in all probability a young specimen thus escaped from its tube. There is no resemblance to a Cephalopod. The vitality displayed by the tentacles is common to almost all the lower forms of marine life."

EVENING MEETING.—NOVEMBER 10TH, 1882.

The President, Mr. W. H. Tyndall, delivered the Presidential Address :—

“On a former occasion, when I had the honour of addressing the Club at the opening of another session, I remarked that this Society was not confined to the study of any one branch of Natural History, but that it possessed the advantage of having all Nature open to the investigation of its members, and that each one might contribute interesting information on some point which was more especially within the scope of his taste or within the sphere of his observations. Natural History, popularly so regarded, seems to have been limited in the minds of many to the consideration of animal life ; but it really embraces the study of Nature under all its aspects. I purpose this evening to confine myself to a branch of Natural History less popularly known *as* Natural History—that is, Physical Geography ; and I think a general survey of the Earth’s surface will afford matter for much interesting and pleasant consideration. Those of us who are charmed with a beautiful prospect, and it is not everyone who does appreciate a fine view, for it requires some cultivation in that direction, or natural taste, to perceive in their fulness the beauties of a landscape,—I say those who do appreciate a beautiful view, whether extensive or not, will perceive considerable variety in the forms which meet the eyes ; and this variety is an important element in the consideration of a prospect. It is one of the elements, when rightly observed and understood, which affords most delight. We can behold at one view only a comparatively small portion of the Earth’s surface, even from a high elevation ; but, having seen a fine prospect, the mind recalls the scene with delight, although the eyes cease to behold it. Thus the mind may be so stored with good descriptions of the varied scenery of the Earth’s surface that similar delight may be felt, though in less degree, from the perusal of graphic descriptions of the country we have never seen.

“On examining good maps, and, still better, a terrestrial globe, we see that of the Earth’s surface about two-fifths is

land and three-fifths water. We see also that the land is so massed in the Northern Hemisphere that the ocean covers the greater part of the Southern Hemisphere. Indeed the surface of the Earth may be so divided as to embrace in one half nearly all the continental land, and in the other Australia and the islands of the South Seas. We notice also in respect of the land that its formation tends to elongation towards the southern extremities rather than towards the north, east, or west. This peculiarity exists in Europe in the Peninsula of Spain and the elongation of Italy. In a more marked degree the Asiatic Continent exhibits in India and in Malay the same peculiarity. In Africa the mass of the Continent is in the north, and from the Equator southward the land tapers until the extremity is found at the Cape of Good Hope. North America terminating in Florida, and South America ending at Cape Horn, follow the same general rule; nor is Greenland exempt from the like characteristic. Of course whatever determines the configuration of the land in like manner but conversely determines the configuration of the seas."

After describing in turn the chief physical features of Europe, Africa, Asia, Australasia, and America, the President concluded by saying:—"If the members of the Club have been able to follow my somewhat imperfect description of the Earth's surface, they will have seen there is great variety to be observed in its general aspect. The study of Physical Geography will enable the enquirer not merely to gain a knowledge of the details, but to put them together in his mind so as to form a mental picture always agreeable to contemplate. There is of course a large amount of detail which may also be studied—the peculiarities of the different oceans, rivers, lakes, continents, and islands; the ranges of mountains, the various volcanoes and their effects; the influence of *tropical* heat on certain districts of the Earth as distinguished from *equatorial* heat; the influence of forests, mountains or seas on climate, and of climate on vegetable and animal life, and on man; besides many other points of interest, the study of which will afford more permanent

satisfaction than any amount of time spent in mere pleasure or recreation. If I have been able to present one branch of the study of Natural History in a favourable light, my labour has been well rewarded."

Mr. H. M. Wallis, of Reading, then read a paper on 'Character, as one of the Causes of the Rarity or Abundance of Different Species of Birds,' as follows:—

Among the many problems which Natural History suggests is one which in different ways is constantly recurring—Why is one species common, and another, closely allied to it, rare?

To reply that one is more perfectly in accord with its environment than the other is unquestionably true; but brings us no nearer to the cause, since it is in most cases impossible to see, and difficult to suggest, the circumstances which favour one species at the expense of another. Why, for instance, should the Blue Tit be more abundant than the Cole and the Marsh Tit, allied species, which in size, shape, habits, nest, egg, and note closely resemble it, and yet are less successful? Let us devote a few minutes to considering this subject, so far as relates to our British birds.

Birds in these islands have rather a hard time of it, many causes having combined to thin the lists of our native species; but on comparing the list of those which are gone or going with those which hold their ground we shall frequently see that those species which appear upon the face of things best able to preserve themselves have suffered most, whilst others obviously hold their own which from feeble power of flight or defence would appear marked out for extinction.

No doubt the causes to which the extinction of a species is usually set down are of great weight, but I question whether sufficient importance is allowed to the action of what perhaps I may call the mental character of the species in question. That each species has a hereditary mental character, who can doubt who has contrasted the calculated boldness of the Rook with the overdone caution of the Crow; or the lighthearted optimism of the Whitethroat with the nervous depression of the Grasshopper Warbler, which never feels itself at liberty to sing in the open, unless a white mist hangs over the fields?

First, then, amongst the mental qualities which as it seems to me assist those species which display them, I reckon courage, whether shown in the pugnacity of the Tits and Sparrows, or in other and less obvious ways, as in the choice of a nesting-site, and in persevering in it under discouraging persecution. Everyone must have seen in spring-time Martins turned out of their nests by Sparrows; even Swifts are sometimes so treated, the bold-faced intruder, notwithstanding the furious swoops and outcries of the larger birds, even dashing out to meet them in the air and engaging in short bursts of futile pursuit. I often see domestic Pigeons driven from their food and cheived by Sparrows. We talk of the "struggle for existence," but in summer-time, when birds most abound, there is food for all, and we see nothing of the sort; but there comes a day when the insects are dead, and worms deep under ground, and it is then that the Sparrow hunts the Chaffinch from the crumbs and the Missel Thrush drives the Redwing from the rowan berries. The struggle for existence is, in most cases, when any actual trial of strength is made, a very brief struggle; watch horses at grass or poultry in a yard—one vicious little cob or ragged cockerel is the acknowledged master; the question was put once and answered long since; now when the chief chooses to feed, his fellows give place. Were food scarce he would starve his rivals as the bolder and hardier birds do the weaker species.

We err greatly in supposing that the balance of numbers among our native birds remains unchanged until affected by man. I know that, apart from *direct* action in game-preserving, the indirect effect of man's works has been widespread; that the Wood Pigeon which was almost unknown in the Lowlands has become abundant as the Sparrowhawks disappeared; that as the Short-eared Owl vanishes as a resident species, owing to drainage, the Long-eared Owl succeeds it as plantations get up.

But how about the Hawfinch, which in Doubleday's time was a rarity and now abounds? Again, within the last three centuries, unaffected by human interference, two resident

species have been all but exterminated by hardier and bolder rivals. In Shakespere's day the Chough frequented Dover Cliffs; it was a well-known bird, and had several local names. Now, driven out by the Jackdaw, it is almost unknown in Cornwall, lingers in Wales, and is nowhere common, even in Connemara. Mr. Dresser (vol. viii., p. 518) quotes Mr. Elwes for the fact that the Manx Shearwater bred in numbers on the Island of Bermera only a century since, but was gradually driven from its nesting-holes by the Puffin. I may add that in the eastern counties the Red-legged Partridge is believed to be ousting the English species, although the latter is protected and its enemy persecuted. So much for brute courage.

The amount of disturbance which birds will tolerate during nesting varies with different species: take all the eggs of a Sparrowhawk, and she will sometimes lay again in the same nest; but the mere presence of a man in the neighbourhood of the Buzzard's eyrie will cause the parents (so it is said) to break their eggs and leave the neighbourhood: how seriously such exaggerated precaution must tell against the increase of a species one sees at a glance. Hence we must allow that mental quality which in ourselves we call "coolness" to influence such sorts of birds as possess it. This coolness, shown by a just estimate of the chances, is possessed in different degrees by the Starling and the Robin, which have so far overcome their distrust of man as to build in exposed situations, yet they will not visit their nests whilst watched. The Swallow tribe, on the other hand, freely enter and leave their nests in our presence. But the Sparrow possesses the quality in its highest form, and, whether in pursuit of food, in the placing or visiting its nest, shows that just appreciation of the chances of which I have spoken. The annual destruction of the eggs and young of these courageous birds is great; it would be less if the Swallow built only in steeples and cliffs, the Starling in ruined castles, and the Sparrow in lofty elms. These situations are suitable, and are resorted to by individuals of the respective species; but the labour of bringing up young in such remotely-placed nests is greater,

and success on the whole less certain than in more dangerous sites. Hence presumably the abundance of these adventurous species.

All birds distrust man, but, whilst some keep their apprehensions within the bounds of reason and experience, as doth the Moorhen, which pays no attention to trains, and may with a little pains be almost tamed, as at Kew Gardens, others cannot control their terrors and permit the distant approach of a little girl to disturb their nest or their dinner, or leave their eggs to grow cold whilst they gratify a passion for solitude in the next parish. Such was the Great Bustard, now extinct with us; such is the Golden Eagle.

Such a mental infirmity must needs be prejudicial to its possessor, for, although in small and inconspicuous species, as the Dartford and Grasshopper Warblers, or the Water Rail, its full effect is not immediately seen, we can see by comparison of these species with their congeners, the White-throat and the Moorhen, that a more forward carriage is compatible with worldly success.

When we reflect that most of these little creatures have daily beats or rounds which they traverse in search of food, it is manifest that a mind superior to unreasonable fears gives a bird a better chance than is possessed by another whose hurried flight for some insufficient cause may mean the loss of a meal, and consequently in severe weather the loss of life itself.

Besides mere pugnacity and calculated courage, there is a quality difficult to define, but valuable to its owner—it is the teachable disposition. Some birds can never learn how far a gun will carry, others betray their nests, others again have made a study of the circumstances and are wiser. Take as an example of an educated bird our Thames Kingfisher. He knows that you want him; he knows also that, let him fly his best, he is anybody's bird at thirty yards; what, then, is the determination of the royal breast? Why, this—that under forty yards he will not give you a chance to shoot. You mark him into a thick bush, run the boat under it and shout—he is quite indifferent; you remain quiet, so does he; at the end of ten minutes he thinks you

are gone and takes wing, but, finding his mistake, *comes back again before you can fire!* This I have seen. Now and again at long intervals a chance presents itself to a man; he is, perhaps, at the time when he first catches sight of this opening, in adversity, going down hill indeed, and one of the conditions of the proposed fortune is an entire revolution in his habits of life or manner of conducting his business; he shrinks from all the change involves and succumbs, or seizes the opportunity and rises. Precisely analogous was the history of the Great Auk. Like most of the sea-fowl, it spent eleven months of the year on the ocean and one upon land, returning year after year to its favourite breeding-haunt; this was its doom; its annual appearance at the well-known spot was waited for, its eggs taken, it was driven into pens and knocked on the head, it was shot at and hunted down, but it still clung to its traditional breeding-sites. It was exterminated in the Baltic, on the coast of Caithness, on the coast of Labrador, in the Hebrides; but had the thirty or forty birds left on the Iceland *Skerry* but made up their minds to separate they might have bred and multiplied. Suitable sites for the one great egg must have existed in plenty around the shores of Northern Europe and America; but they refused to alter their habits, kept together, and perished.

As a contrast consider the Greater Shearwater, a bird not so well adapted to its circumstances as was the Great Auk, since it has never been anything but extremely rare during the last century; but owing to its solitary habits nothing whatever is known of its nest and egg, and it may consequently maintain itself in peace.

That such a change of habits as would have saved the Great Auk from extinction is not beyond the compass of a bird's intellect we may see from the suddenly changed manners of some of our own native species; thus the Stock Dove had nested in rabbit-holes on the warrens of Norfolk from time immemorial. About fifty years since it was found necessary to cultivate these sandy wastes, and as a preliminary step hedges were planted and rows of young timber set to act as

screens. As soon as the trees were high enough the Wood Pigeons built in them, but the Stock Doves kept to their burrows; at last the "brecks" were ploughed up, and the birds dispossessed. For two or three years they were at their wits' end, laying their eggs, says Mr. Stevenson in his 'Birds of Norfolk,' in the bottoms of the hedgerows; but, wiser counsels prevailing, they eventually took possession of the young timber, building at a greater height than the other species.

About the same time, when planting became general in West Norfolk, a colony of Herons, which had nested from a time beyond memory *upon the ground* among the fens, removed all at once to a plantation which had reached a respectable height, the growth of which had evidently interested them and been the subject of consultation perhaps for years. Incidents such as these, both of which rest upon the authority of Mr. Stevenson, give us a clue to the enigma which presents itself when we see the Stock Dove thriving on the south coast, and the Rock Dove become extinct there within the present century; the Heron hold its ground, whilst the Bittern and Spoonbill die out.

In the successful species we have evidently birds possessing an adaptive faculty, of which the Swallow, the Martin, and the Swift are eminent examples. Where did these birds breed on these islands before the era of chimney-stacks and well-roofed houses? They must have been exceedingly local, the Swallow especially, which I have never met with nesting in a strictly wild condition, for the Martin and Swift breed on the sea-cliffs, and the former at Malham Cove, in Yorkshire. So successfully has the Swift accommodated itself to its new conditions that I think it outnumbers within the borough of Reading the combined forces of Martins and Swallows; indeed there are some reasons for suspecting that it begins to find nesting-sites scarce here, for I have seen it breeding behind the loose face of a church-dial, and under the eaves of low-built cottages and new suburban villas, scarce eighteen feet from the ground, searching the eaves of small and new houses, and wriggling in and out of the interstices of some carved stonework in front of a warehouse.

Another bird which illustrates the adaptive faculty is the Starling. When your grapes are ripening he will attack them, but his ordinary food is some sort of grub which he gets in the pastures; at the same time on any warm day between April and October he may be seen hawking for flies, like a somewhat maladroit Swallow. One can without difficulty imagine circumstances under which the Starlings of Great Britain, which I believe do not migrate, might be compelled to elect between starvation and a summer diet almost exclusively of insects caught on the wing. Under such circumstances one would expect a great decrease in their numbers, but a survival of the species, the wing and tail being probably modified in the course of many generations. That the alternative which would be fatal to many other species would be fatal to the Starling one can hardly believe. One is but too apt to consider that a change of habit or mode of life in a species must be by slow degrees; but there is good evidence that this is not always the case, as I have shown, and certain undisputed facts go to prove that so important a revolution as a change of diet from vegetable to animal food is sometimes effected *per saltum*.

The great Ground Parrot of New Zealand is believed to have been confined to a vegetable diet, fern-roots belike, or such-like harmless matters, until the introduction of sheep some forty years since, when the bird developed an extraordinary taste for mutton. For the sake of Science it is almost a pity that so interesting a problem was not permitted to work itself out; an islet might have been stocked with Sheep and Parrots, and carefully guarded from intruding naturalists and wool-staplers for, say, a century. What would have been the result is now of course impossible to forecast, but had the supply of Sheep supported a stock of Parrots it is not unlikely that so great a change in fare would have been followed by further changes in plumage, bulk, and weapons.

Although this instance stands alone, as far as I know, with regard to the size of the quarry marked out for food by the new carnivorous instinct of the bird, yet it is not without bearing upon the question that a fowl will sometimes run

down and kill a mouse, a Moorhen eat young birds, and a Great Tit make prey of birds but slightly smaller than itself.

EVENING MEETING.—DECEMBER 8TH, 1882.

A paper was read by Mr. Edward Bidwell, of London, on the 'Bird-Life of the Bass Rock and the Farne Islands,' illustrated by numerous specimens of birds and eggs, and a large number of photographs.

Mr. J. B. Crosfield, who had paid a visit to these islands recently, added some interesting particulars of his own observations.

EVENING MEETING.—JANUARY 12TH, 1883.

The Chairman handed the prize of £1 to Mr. K. Peters, which had been awarded to him by the Committee for his collection illustrating fifty-three natural orders of plants.

Mr. J. J. Gill exhibited a living specimen of the old English Rat (*Mus rattus*) the property of Mr. J. W. Ashby, Redhill. Several specimens have been seen in the warehouses in Idol Lane, Tower Street, London.

Mr. John Linnell presented a copy of a List of Fossils in the Cabinets of Messrs. C. Upton and S. Webb, prepared and sent for presentation to the Club by the latter. The list contains the names of the fossils arranged in their respective classes, with the localities in this district where they were found, and the geological formation in which they lay.

Mr. Henry Boyle, M.A., of Clapham, read a paper on 'The *Saprolegna ferox*,' as follows:—

The subject upon which I propose to make a few remarks, viz., the habit and growth of *Saprolegna ferox*, is one which is at the present day of great importance, and likely in the future to be of immense interest to the people of England. The newspapers are never tired of giving statistics of what the price of fish should be and what it is; the eyes of all the people are turned to the fish supply as one of paramount

importance, and it is only because the Corporation of London saw that resistance was in vain that lately they allowed themselves to be beaten from their old monopoly of Billingsgate and sanctioned an additional market. In speaking of fish we all think first of Salmon, the king of fishes; and it is the Salmon which brings most closely home to us the pest we are about to discuss, and hence its chief public interest at the present time. The Salmon and all fresh-water fish are liable to be attacked by a fungoid growth which affects their bodies externally, and finally destroys them. The name of this fungus or parasite is *Saprolegna ferox*.

After quoting a description given by Mr. Stirling, of Edinburgh, Mr. Boyle continued:—It has been stated that the fungus dies with the fish. I have not found this to be the case. On the contrary, all my observations have been from dead fish. Some of the specimens sent me from Carlisle by Mr. Dunne were mis-sent to Aberdeen, and returned to me on the seventh day after the death of the fish; and yet I have scores of permanent preparations from these specimens, which show distinctly the characteristic forms of *Saprolegna ferox*. I have also found the fungus perfectly identical in all the specimens I have examined, which consist of Salmon, Sea-trout and River-trout from the Eden, and Salmon and Grayling from the Nith.

Before us lie the two problems:—Why does the disease come? How can it be cured or checked? Its appearance is that of transparent whitish fur, and when it attacks it eats away the skin and slowly spreads. It usually appears first on the tail or fins, destroys these entirely where it lies, then spreads to the body and finally to the gills, chokes them up, and the fish dies of suffocation. The progress of the disease is slow; the fish swims aimlessly about for weeks in constant motion, striking everything in its course and sometimes half-burying itself in mud, then it swims entirely at the top, and presently dies. Sometimes it appears upon the eyes, but rarely. Another disease attacks the eyes, causing them to bulge greatly and then to drop out. I have seen instances of this in several cases of Charr and Goldfish.

This disease does not kill the fish, and is not *Saprolegna*. *Saprolegna* is, as far as we can speak positively of anything, always fatal. I have seen hundreds of fish die from it, and never one recover. Many theories have been advanced to account for it, overcrowding being the principal. I have seen no evidence of overcrowding producing it, though I do not go so far as to say that it will not do so. I have seen much overcrowding, but no evidence of *Saprolegna* arising from it. The view that I take is that it arises from change of temperature affecting the fish prejudicially, and reducing it to a lowered condition, in which it is liable to the disease. Some hold that it is infectious; probably it is, but it will not on that account necessarily affect healthy fish.

I think if we examine the cases of overcrowding fish being affected we shall always find that at the same time there is change of temperature, and this in my opinion is the true cause. I will instance overcrowding where certainly the disease is not induced. Take the warm engine-pools at mills where Goldfish swarm to an extent utterly unknown under natural conditions, where numbers are kept down by the predatory fish; here there is no *Saprolegna*. But take some of the fish, as I have done many times, and put them into a globe, giving them water at ordinary temperature, and in a few days the disease appears and carries off all, though sometimes one or two are unaffected and survive. The greatest care is necessary in gradually accustoming the fish to cooler water. To carry this instance further still: the Goldfish sold by the aquarium-dealers of Seven Dials are generally acclimatised and quite healthy, but immensely crowded. I have taken fifty or so of these fish to Westmoreland, and placed them in a large open pond of spring water; nine-tenths have always died of *Saprolegna* because the water was so much colder than a London shop; but here was no overcrowding. Again, I have seen a globe in London filled with Sticklebacks, and every one affected, a miserable sight; yet the ponds from which they are taken are always overstocked, yet perfectly healthy. I have seen dead Sticklebacks in ponds, and dead Roach in ponds teeming with them; also Goldfish, but they

have not apparently died of *Saprolegna*. It is when the ordinary conditions of life are changed that they die of this pest. Also the change from cold to heat seems to induce the disease. The Sticklebacks mentioned above were taken from ponds round London, and exposed to the sun in shop-windows; and the temperature would probably be 75° or 80° by day, while the pond would be 65° in summer at most.

Sometimes the Dace die in great numbers in the Thames in summer; the gills are choked with *Saprolegna*, and the summer heat is the probable cause. When Charr are caught in Windermere they are taken from a depth of 60 to 100 feet, and are put in boxes under water at Waterhead to be taken out and sold by degrees. These fish are instantly attacked, and, I grieve to say, the fishermen, knowing the fatal nature of the case, always pick out the most diseased fish to sell first. Now this does not come from change of pressure from one hundred feet of water to two or three. When the change of pressure affects a fish prejudicially it swells the air-bladder, the fish comes to the top, and remains there till the bladder either bursts or adjusts its muscles to the relieved pressure. Perch taken in winter from the deep water of Skelwith Pool generally burst the air-bladder when put into the bait-can. I never saw a sign of this in Charr, though coming from water so much deeper, nor did they seem inconvenienced by the change. I once took twenty Charr from Windermere and put them into a tank with a stream of spring water running through it; in four days *Saprolegna* appeared on all, and they died. These Charr were taken in winter before the fence laws came in, and I have little doubt that the change was from cold to heat; for the winter temperature of the depths is always 38°, and, as Charr are not taken in cold weather, the temperature of the shallows would probably be about 45°, and my tank would be much the same. As Charr are inhabitants of deep lakes only, this question of temperature is probably of vital importance to them.

I never saw a Trout affected; but Trout are singularly hardy and adaptable fish, requiring only one thing, and that imperiously, namely, well oxygenated water; all other things

they seem indifferent to. I never saw a Tench or a Carp affected. Roach, Dace, Bleak, Charr, and Goldfish are singularly liable. Gudgeons are very free, Chub less so. Of course I refer to these fish under comparatively altered conditions, such as change from a river to a pond or tank, with the accompanying change of temperature. I will close my list of instances by a reference to fish hatching, though if it were proved that *Saprolegna* attacked the ova it would be plain that change of temperature is not the sole cause of its appearance. The ova in my experiments were subject to two fatal maladies, one of which changes the ovum from transparency to white opacity, and the other furs it over like mould. This mould glues the ova together, and is fatal. It does not quite resemble *Saprolegna*; and I do not think that Mr. Frank Buckland describes it minutely, though he notices it as an enemy. The other ailment is probably simple death from weakness, unaërated water, or the punctures of the Water Shrimp.

Returning to the Salmon, what do we find? On the Tay and all the chief Salmon-rivers of Scotland there is at times a large mortality; these fish are all affected by *Saprolegna*. The disease runs its course in autumn and winter, and the fish lie dead on the banks by hundreds. The explanations are manifold—changes from salt-water to fresh; overcrowding in the weir pools, where fish congregate at the foot of the weir to await a flood; fighting amongst the males; exhaustion from travelling so far; snowbroth, &c. With regard to the crowding—Why is there not the mortality every year? and this would also dispose of the fighting theory, the salt water, and the exhaustion. In the great Canadian rivers of the West Coast the Salmon are in such multitudes in their migrations that they are said to shoulder each other out of the water; on such a scale the death-rate from overcrowding should be tremendous, and from exhaustion frightful. The snowbroth theory has more to recommend it, but it would require careful tables year by year to prove the case. This would also be included under the general head of change of temperature. That snowbroth is excessively disliked by

Trout and Charr is a matter of faith with fishermen, but to instance this as a cause of *Saprolegna* when it attacks fish quite as freely in summer is absurd.

To sum up this evening's notice of this most obscure though widely-distributed disease, I will mention as to its cause and remedy the opinions of Mr. Tegetmeier and Mr. Stirling. Mr. Tegetmeier says:—"My belief is that this disease does not break out spontaneously upon all or any fish; but that in the first instance it invariably attacks fish that are already in bad or lowered health, or are otherwise diseased; but when it has got ahead it attacks even healthy fish. And this we find to be the course with most diseases that are epidemic." Most of the fish from the Eden were terribly infested with tape and other worms of considerable magnitude, while there were some good fish attacked, which in some sort verifies our assumption. The latter assumption I should be slow to allow, as the difficulty in proving the health of the fish would be insurmountable; also tape worms do not at all prove fish to be unhealthy, perhaps even the reverse. He proceeds to describe Roach which he kept in a tank as baits, amongst which the disease often appeared, and says—"Many times have I seen fungoid disease occur to these fish so confined, and, what is more remarkable, in almost every case it has been at about the spawning season, the time when it is most active in Salmon. In my experience it appears at all seasons, though I should readily allow that the spawning season would be most suitable, as the fish would be more susceptible of changed conditions." But on this point we may ask why it should chiefly attack the male Salmon, as it undoubtedly does. Is it sent to clear away the useless superfluity of males, as the bees kill the drones and the female spider kills the male; and are the males for that reason more prone to attack? The observations of Mr. Blackwell (of the Conway) may throw some light upon this point, for he wrote a paper on the subject, and told me personally that he had examined the stomachs of hundreds of Salmon and always found them quite empty. He said he was convinced that they never ate anything during their stay

in our rivers. With regard to their taking flies, he held that they did so merely as a habit, and never attempted to swallow them; and this accounted for their preferring tinsel and bright colours, for no one would contend that a Salmon-fly resembled anything in Nature. I have also caught Pike in the Isis with the established Pike-fly made of two eyes of Peacock-feathers, and certainly unlike anything a Pike has ever seen. Mr. Tom Stoddart, the author of the 'Angler's Companion,' agrees with Mr. Blackwell on this point. Mr. Blackwell, who was a great Salmon-fisher, said that when Salmon were in a rising, or as he said playful, mood, they rose freely at falling leaves, or in fact anything that attracted their notice. I asked him what he thought of their taking worms, and he said that though they took, they would not swallow them. The old male Salmon are very troublesome on this account to Salmon-fishers, for the under jaw terminates in a hook, which prevents the closing of the mouth at the sides; and when they take the fly, as they do not pretend to swallow it, it slips out at the side, and they often rise several times without being hooked. This abstention from food would of course lower the vitality, and would conduce to liability to disease. This is not altogether satisfactory as an explanation, as the female fish should be equally affected, and they are not.

Mr. Stirling says:—"Regarding the cause of the disease, I can offer no opinion further than that some functional condition of the fish seems necessary for the propagation of the fungus. The germs of *Saprolegna* must exist at all times and in many places, and, if so, there must be a reason why fish are not constantly affected by the fungus, and in every river. I am persuaded that the condition of the fish is in some way either suitable or unsuitable for the propagation and growth of the fungus. [It has also been said that a salt solution destroys the fungus, which is said to melt in the solution like sugar in water. On the contrary, salt and water is an excellent preservative of *Saprolegna*. Masses of it before me as I write have been in a salt solution for two months and remain unaltered. Further, the Salmon captured in the

Nith, which is believed to have gone to sea in order to get rid of the fungus, had the fungus growing vigorously on several parts of its body. The fungus must either have instantly attacked the fish on its return to the river or not have been destroyed during their stay in the salt water.] Whether this arises from too high or too low a condition I am quite unable to say, but I may remark that while some of the fish examined were in the kelt stage, others were in a condition perfectly fit for food." I have found dead fish in an advanced state of decomposition covered from head to tail with a furry coat. Whether this was *Saprolegna* or not I cannot say, for the examination is not inviting; but it would be interesting to know whether, if it be *Saprolegna*, it attacks the body after death, and is in fact a form of putrefaction. If so, it would suggest the theory that from some cause the protoplasm has died in the parts where the fish is affected, and the destroying spores of the fungus seize upon the spot at once.

Mr. Tegetmeier and Mr. Stirling are agreed that the disease appears first upon unhealthy fish, unhealthy from possibly many causes. I would only add to this that the first cause is change from high to low temperature; secondly, any change of any sort. We can produce it at will amongst Goldfish by lowering the temperature; we see it daily on the solitary Roach or Gudgeon in the chemist's shop. It is plainly not produced by overcrowding where temperature and water are unaltered. It is omnipresent and ineradicable; it is hopeless to dream of cure. It must be taken as a great and hostile factor in all attempts at fish-culture, except under purely natural conditions, and plainly not altogether under those conditions. The only gleam of satisfaction is, that as it is rare in nature and as we have no data to show that it destroys the Salmon in rivers of Canada or the extreme Highlands, where there are neither mills nor agricultural drainage, it may possibly be these causes which, in conjunction with low temperature, so weaken the vitality of the fish that it falls a ready prey to the disease.

In discussing Mr. Boyle's paper Dr. Bossey suggested that

perhaps the fungus sometimes seen on dead fish might have something to do with propagating the disease, as millions of dead flies are constantly falling into our streams. He doubted if change of temperature was a sufficient cause, though he thought perhaps the infection of sewage-matter might have something to do with it. *Saprolegna* was a comparatively new disease. Mr. Boyle stated that fish just newly returned from the sea were not attacked by the disease, and that the germs were probably omnipresent, and not introduced into any water by the fish.

EVENING MEETING.—FEBRUARY 2ND, 1883.

Mr. John E. Littleboy, of Watford, read a paper on 'The Migrations of Birds.'*

EVENING MEETING.—MARCH 9TH, 1883.

This meeting of the Club was made of a somewhat more popular character than the ordinary meetings, and invitations were issued to many of the schools and to young persons generally in the neighbourhood, a large number of whom were in attendance.

A popular lecture, entitled 'Geology made Easy,' was delivered by the Rev. Henry Brass, M.A., F.G.S., during the course of which the lecturer described the nature of the crust of the earth generally, exhibiting a large diagram which presented the various strata forming the earth's crust. He then described more in detail and by help of a large map the geological formations to be met with between London and Brighton, and answered the question often asked, "What is the use of Geology?" pointing out how useful geological knowledge has been in the discovery and working of coal-fields and mines of various metals. He concluded by a description of the chief features to be noted in the Geology of our own neighbourhood, and exhibited a large collection

* This paper has been published in the printed 'Proceedings of the Hertfordshire Natural History Society.'

of fossils illustrating the strata to be seen at or near the surface, and described where the chief fossils were to be found.

EVENING MEETING.—APRIL 13TH, 1883.

Mr. Richard Noakes presented to the Club a collection of Mosses.

Mr. W. H. Tyndall read the following Meteorological Notes for 1882:—

The statistics of Meteorology are not usually interesting, unless they embrace some remarkable occurrences or variations from the ordinary features of the weather. The year 1882, so far as relates to Redhill, is not remarkable for any special phases of the weather. It is true that in the months of January and February (from January 8th to February 10th, *i. e.*, for thirty-four days consecutively) the barometer stood above thirty inches, reaching a maximum of 30·88 on January 18th; this is very unusual. It stood at 30·77 on January 16th; 30·85 on the 17th; 30·88 on the 18th; 30·84 on the 19th; and again on February 20th it reached 30·78. These were the highest points reached at any time in the year. The lowest recorded was on March 1st, when it fell to 29·00. January exhibited the highest average (30·32), next February (30·23), then March (30·01); and December the lowest average (29·67), then November (29·71), and then April (29·79).

In regard to the thermometer, the maximum reached was 78·5° on August 2nd, and the minimum 15° on December 10th, so that the extreme range was only 63·5°. In the neighbourhood of London we may look in some years for an extreme range of nearly 100°. I have seen it -4° in 1838, and also at 94·5° on June 16th, 1858. On only eighty-two days did the thermometer fall to freezing-point—seventeen days in January, twelve in February, fourteen in March, five in April, one in September, five in October, eleven in November, and seventeen in December. On the whole the temperature was below the average for the year. It was above the average for the first five months; considerably below for the last seven months. On eighty-two

days it fell to 32° and under; on thirty days it rose to 70° and upwards, but it never reached 80°.

In regard to rain, the total of the year was 33·14 in., which fell on 205 days. The driest month was March, when 1·26 in. fell; the wettest, October, when 6·51 in. fell. But as regards days on which rain fell, there were fewest in September (ten only), and most in December, when rain or snow fell on twenty-five days; so that the greater number of days on which rain may fall in a month does not necessarily indicate the greater amount of rain, for there may be a fall in any one day which shall exceed in amount the fall of all the other days in the month put together. The heaviest continuous fall was on October 27th and 28th, when 1·65 in. fell in the two days; but the fall on April 25th was heaviest for any one day, when 1·02 in. fell. There were only nine periods of consecutive six days on which some rain fell each day. It is remarkable that the heaviest falls were on February 25th, March 25th, April 25th, June 24th, July 24th, and on the 28th of September, October, and November. The coincidence of dates may not, however, indicate any law as to the fall of rain. From the heavy fall of rain in October, we may look for the rise and flow of the Bourne through the Caterham Valley, a phenomenon which has been referred to on a former occasion when the subject of rain was under discussion by the Club. There was snow on March 21st and 22nd, and sleet on March 26th; and again on November 15th and 16th, and on December 6th; but the amount of snow that fell during the year was but small.

Wind.—There were gales the first week in January, but they were not excessive. The remainder of January was of note for the almost absolute calm which existed from the 12th to the 27th of the month, accompanied with some amount of fog. In London and the suburbs the absence of wind is almost sure to cause fog, especially the fog arising from smoke. In February again, from the 1st to the 12th, there was almost a total absence of wind; all this time the barometer stood very high. In March there were gales on the 22nd and 26th from the N.W., the one on the 26th being

the heaviest and accompanied by an unusual roaring of the wind. April is of note for a remarkable gale, commencing on the 28th from the S.W., and veering in some parts to the S.S.E. on the 29th (with a very low temperature for the time of year and having regard to the direction of the wind), when the gale was of a most tremendous character. It must have raised the foam of the sea so that the salt from the water was carried over land as far as the line of hills by Norwood; the windows in Redhill facing the south were encrusted with salt. The young leaves of the trees were blackened and bruised as with sharp frost. The fruit trees in blossom were devastated, and the promise of a fruitful season was at once dissipated. A storm so damaging for foliage and fruit-blossoms has probably not been experienced for very many years. There was a smart gale from the W.S.W. on August 28th, and one on September 2nd; these were the only summer gales experienced. There was also a heavy gale on October 28th.

A fine Aurora was observed on November 17th, which lasted many hours, assuming a bright rose tint, like the reflection of a great fire, and flashing up to the zenith late at night and early in the morning. Of late years the Aurora has not been much seen in the neighbourhood of London; there were frequent displays about twenty to twenty-five years ago.

Thunder and Lightning. — Redhill is not much visited by thunderstorms of a severe character, and the past year has not experienced great electric disturbances. Thunder was heard on June 27th, August 12th, and October 1st.

On Monday, February 13th, there occurred a most beautiful sunrise, surpassing in loveliness anything of the kind I ever saw. To describe it with anything approaching to accuracy would be impossible. It was seen over a large district. A cloud appeared like an island of rosy hue situated in a sea of most beautiful azure; around this sea clouds represented land swelling into mountains of varied and beautiful outline, their peaks terminating in an atmosphere of light yellowish green. What added charm to the whole was the exceeding clearness of the air, and the stillness, freshness, and quiet of the early morning.

METEOROLOGY. — OXFORD ROAD, REDHILL, SURREY (1882).

BAROMETER.				THERMOMETER.						RAIN.			
Month.	Max.	Date.	Min.	Date.	Max.	Date.	Min.	Date.	Average.		Mean.	Total of Month.	No. of Days ·01 fell.
									Max.	Min.			
Jan. .	30·88	18	29·30	13	52·0	6	20·0	24	43·93	31·60	37·77	1·85	15
Feb. .	30·78	20	29·16	27	55·0	14	20·5	1	46·78	34·75	40·91	2·16	11
March	30·56	17	29·00	1	59·0	11 & 18	25·0	22	53·00	33·90	43·45	1·26	13
April .	30·30	8 & 9	29·26	8	63·0	20 & 21	28·0	10	56·91	36·59	46·75	3·29	17
May. .	30·46	17	29·49	25	73·5	22	33·0	16	63·72	41·80	52·76	1·63	13
June .	30·33	1	29·51	9	73·0	29	39·0	12	65·40	46·85	56·12	2·46	21
July .	30·50	27	29·46	7	74·5	30	44·0	19	68·57	50·13	59·35	3·18	20
Aug. .	30·30	4	29·34	23	78·5	2	41·0	8	68·77	49·01	58·90	1·98	15
Sept. .	30·38	7, 8 & 9	29·32	29	68·5	2	31·0	14	62·12	43·77	52·94	2·61	10
Oct. .	30·46	5	29·25	24	69·0	1	26·5	29	56·52	40·97	48·74	6·51	24
Nov. .	30·13	6	29·13	16	59·0	5	20·0	17	47·82	34·43	40·90	3·12	21
Dec. .	30·31	20	29·08	15	58·0	31	15·0	10	43·34	30·95	37·47	3·09	25
Year.	30·88	Jan.	29·00	Mar.	78·5	Aug.	15·0	Dec.	56·41	39·56	48·05	33·14	205

The Secretary then read the following Reports of the Excursions, furnished chiefly by the various conductors during the last summer:—

CATERHAM JUNCTION AND CROYDON.—April 22, 1882. Leaving Caterham Junction Station, we went for some little distance along the road that ascends the Caterham Valley, having on our right hand the channel down which the intermittent stream known as the Bourne flows at uncertain intervals, usually for a few months about every five years. We soon ascended on to Riddlesdown, and on coming to one of the ventilating shafts of the tunnel through which the new line now in course of formation passes under this hill we made our way down into the deep chalk-cutting at the S.E. mouth of the tunnel, and spent some time searching for fossils, a few of which were found. Re-ascending the downs we then continued our course by lanes towards the village of Sanderstead. Several Nightingales were heard singing as we passed along in the copses near the roadside, and among other migratory visitors whose songs called attention to their arrival again in this country were the Whitethroat and Cuckoo. In Sanderstead Churchyard *Saxifraga granulata* was found in flower, and in a wood close by *Veronica montana* was met with in some abundance. The next point of interest was Crohamhurst, a well-wooded hill consisting almost entirely of the rounded pebbles known as the Oldhaven Beds. As very little soil is intermixed with these, the surface of the hill-side is in some places very loose, resembling the shingle of a sea-beach. In a small excavation at the foot of the hill these round pebbles were found to be resting absolutely on the chalk; and it was curious to observe how some of them had worked their way downwards and some of the irregular chalk-flints had worked upwards, so that here and there the two were intermingled; the one probably still remaining in the same position, and, comparatively speaking, almost the same shape in which they were originally deposited; the other the result of the *débris* left behind after the denudation which removed the chalk and other beds which once extended over the Weald area, subjected to a long course of rolling

and wearing by the waves upon a sea-beach until their present rounded form was attained. Descending Croham-hurst on the other side, the party proceeded to the conspicuous water-towers, where other members of the Club as well as a good many members of the Croydon Microscopic and Natural History Society and their friends had assembled. Under the guidance of their former President, Mr. John Flower (who, as probably most present are aware, has since been removed by death, greatly to the loss of the Croydon Club and of Science generally), the party then walked along the Combe Lane as far as the point where it is crossed by a bridge of the new line of railway now being made to connect Woodside with the main line of the South Eastern Railway not far from South Croydon Station. Proceeding along the line in a southerly direction, in order to inspect first the chalk-cutting through which the line runs, Mr. Flower pointed out several good examples of what are known as "pockets" in the chalk, *i. e.*, holes of various sizes and shapes filled with surface-clay or gravel, usually having a thin band or layer of similar clay communicating with the surface. He explained that these pockets were probably formed by the action of water which had become charged with carbonic acid, and thus converted the chalk in some places into a bicarbonate of lime. This is readily soluble in water; and had doubtless become dissolved, and the surface-soil had gradually washed down and filled up the space so left. In some of these pockets rounded flints, evidently from the Oldhaven Pebbles, were observed, some of them of considerable size. Walking from the chalk-cutting northward, soon after recrossing Combe Lane we again came into a cutting where a remarkable variety of strata was displayed. The lowest in the series was the Thanet Sand, a bed of a pale yellowish colour; next above this came the Greensand of the Woolwich and Reading Beds, a marine deposit by no means to be confounded with the Upper Greensand or Lower Greensand with which we are so familiar in the neighbourhood of Reigate, from which it is separated by a vast interval of geologic time. In the lowest two or three feet of this Greensand large quantities of Sharks' teeth have

been found, and a good many were discovered after some careful digging by various members of our party. Many oyster-shells are also to be found, mostly lying detached, thus indicating that they had lived on a still bottom. This bed of Greensand is about sixteen feet in thickness, and at the top of it is a band about eighteen inches thick of very hard lavender-coloured concrete, composed of pebbles and shells. Above this are seen the beautifully-coloured clays of the Woolwich and Reading series, the lowest bright yellow, then green, purple, and dark blue, almost black. All these colours are not, however, displayed in this cutting; as the strata dip considerably to the north, we have to proceed some distance further in that direction before reaching the uppermost beds; this soon brings us to a tunnel one-third of a mile long, from which the excavations consist chiefly of the purple and dark-blue clays. It was then being excavated through several shafts, the borings not having yet begun from either end. Several of the party descended one of these shafts, and were much interested in seeing the work of digging, propping, and building up the brickwork going on. Timbers of great size and strength were required to support the roof, and new ones had to be continually advanced and carefully wedged in their positions as the length of the boring was increased. We were told that after the brickwork is all built up it requires to be still propped for about three weeks, when it is completely set, and the supports are removed. Still, with all precautions, these stiff plastic clays are very dangerous to work in, and several accidents have occurred. (Since the time of our visit the tunnel has fallen in, by which the progress of the railway has been much retarded). In the cutting at the north end of the tunnel the dark clays are the lowest series exposed; the top bed of these is intensely black. Above these occur the Oldhaven Sands, pale in colour, which extend along the whole of the remainder of this cutting. The entire thickness of this stratum is about twenty-seven feet. At the base, immediately above the black clay, is a very hard bed composed of shells and pebbles. The whole of the various interesting strata so excellently displayed in these cuttings were pointed

out and clearly explained by Mr. Flower, who also very kindly assisted some of our members in selecting typical specimens, with which several returned home rather heavily laden.

FLANCHFORD AND SIDLOW.—May 6. (Conductor, Mr. J. B. Crosfield). The party met at the west end of High Street, Reigate, and proceeded down the lane past the Priory and across the fields to Littleton, continuing thence by the field-paths until they came out into the road about half a mile from Flanchford Bridge. In passing through one of the fields a good many specimens of the rough Long-headed Poppy (*Papaver argemone*) were found in flower, having the petals laciniated usually into three segments each. It was at first thought this might be due to some accident, the boisterous weather, or other cause; but on unpacking some buds the crumpled unexpanded petals contained in them were found to be laciniated in a precisely similar manner. Some specimens were met with which had the petals entire, but these were less frequent than the laciniated variety. The party walked along the edge of part of the mill-pond at Flanchford, where a number of Sedge Warblers were singing with grating notes; here also a Kingfisher was seen by one of our number. Immediately after crossing Flanchford Bridge the party turned once more into the fields by a path on the left, which leads at a short distance from the Mole past Mr. Charrington's house, and onwards by way of lanes and field-paths till we again came out into the road about a mile S.W. from Sidlow Bridge. Striking evidence was afforded of the early season by many of the Hawthorns, which were already a mass of blossom. Everywhere also the results of the extraordinary gale which occurred exactly a week before, *viz.*, on Saturday, April 29th, were apparent. On almost all trees and hedges which were at all exposed towards the west, and on which the leaves were wholly or partially expanded, but still kept soft and tender, the young foliage had been seared and withered terribly, on some trees appearing almost black. It was very singular to observe the east side of a tree exhibiting foliage green and fresh, while on the west side it

was completely withered and blackened, or sometimes the tree was almost stripped bare. The Hawthorns, Horse-chestnuts, and Limes seemed to have felt the effects of the storm most; Beeches and some other trees that were less fully in leaf had not suffered quite so severely. These remarkable effects were attributed by some to the presence of salt in the winds; but, though salt was doubtless present, probably the force of the wind together with the low temperature which prevailed during the latter part of the storm, when the temperature fell below the freezing-point, was quite sufficient of itself to produce the results which were everywhere apparent.

CROWBOROUGH.—May 20. (Conductor, Rev. H. Brass, M.A.) Starting from Withyam Station, the route lay through Buckhurst Park, a beautifully-wooded property. In the turf near the lake in the park *Orchis morio* and *O. maculata* were most prettily dotted. On an old wall abundance of *Asplenium Ruta-muraria* was noticed, and *Polygonum bistorta* abounded in a meadow. Ascending through woods where the Garden Warbler and Wood Wren were singing, the range of the Sweet Mountain Fern (*Lastræa Oreopteris*) was reached. The open common was crossed, and the transit of a few fields brought us out on to the high road which crosses the very summit of Crowborough. Here we were most kindly entertained by Mr. Prince, who showed us his observatory and astronomical instruments. The prospect reached from the North Downs, near Dover, to Beachy Head; the South Downs from Beachy Head to Lewes, and on to Ditchling Beacon, Wolstenbury, and Chanctonbury; Leith Hill and Hindhead, and the range of the North Downs from St. Martha's Hill, near Guildford, to Reigate Hill, Whitehill, Tandridge Downs, and the range eastward through mid-Kent.

CHALDON AND FARTHING DOWN.—June 3. (Conductor, Mr. A. J. Crosfield). The whole course of this excursion, after crossing the first two or three fields on leaving Merstham Station, was over the chalk; less was met with in the way of Natural History worth recording than on most of the other excursions this summer. The route led the party through

the village of Chaldon, and they took the opportunity of going into the church to see the curious old wall-painting which was discovered at the time of the restoration of the church in 1870; it is about 17 ft. by 11 ft., and is believed to date from about the year 1170. The subject of the painting is the Ladder of the Salvation of the Human Soul, and the Way to Heaven. The lower portion of the picture represents the torments of the lost, depicting various special punishments for particular sins. The upper part represents the souls who are saved. On a ladder in the centre of the picture are a number of figures endeavouring to ascend, and some in the lower portion are represented as falling off. A large number of symbolic figures are introduced in the picture, some parts of which are very indistinct. A pleasant walk along lanes through a wooded country led the party out on to Farthing Down, one of those open uncultivated extents of country so frequently met with on the chalk. A Mole was caught alive by one of the younger members of the party, but was ultimately permitted to make its escape into the ground again, which it did not all at once find it easy to do, the soil being rather too hard and strong for it to burrow into very readily. Many of the usual chalk plants were met with. The walk was continued to Caterham Junction Station, whence the excursionists returned home by railway.

SILENT POOL. — June 17. (Conductor, Dr. Bossey). On Saturday, June 17th, a whole-day excursion was made to Gomshall, in order to visit the pond about two miles distant, known as the "Silent Pool." Some time was first spent in botanising in the marsh just below Gomshall Station. The Bog Pimpernel (*Anagallis tenella*) and the Buckbean (*Menyanthes trifoliata*) were gathered. *Veronica Anagallis* was found, approaching in habit to *V. Beccabunga*, so as to suggest the idea of a cross between the two. The party then had a rather dusty walk to the Pool. There are actually two ponds, one lying a little below the other. The upper one is that designated the Silent Pool. It lies at the foot of the chalk-hills, and is quite surrounded and overhung by trees. It is of no great extent, and were it not for the rare occurrence of

springs, streams, and ponds on the chalk it would probably pass almost without notice, as its special characteristics would be found reproduced elsewhere. The stream that supplies it is a very slender one, but suffices to keep up a slight current through the pool. The water is perhaps eight feet deep, and is perfectly clear; and the white chalk bottom gives to it a beautiful bluish tinge. There are a considerable number of good-sized Trout in the pond, evidently accustomed to be fed by visitors; they would come with a sudden dash at a bit of bread thrown in to them, and seize it and be off instantly. A Yellow Wagtail was observed by the Pool, a species of bird not so common in our neighbourhood as in others where water is more prevalent. While the party were partaking of lunch in the summer-house erected on the edge of the Silent Pool, our conductor, Dr. Bossey, exhibited under a small microscope specimens of Diatoms which he had obtained from the Pool a few days previously, including the following species:—

<i>Amphipleura pellucida.</i>	<i>Navicula ovalis.</i>
<i>Amphora ovalis.</i>	<i>Nitzschia Sigmoidea.</i>
<i>A. minutissima.</i>	<i>Odontidium mutabile.</i>
<i>Campylodiscus costatus.</i>	<i>Orthosira arenaria.</i>
<i>Cocconera lanceolatum.</i>	<i>Pinnularia acuta.</i>
<i>C. cistula.</i>	<i>P. major.</i>
<i>Cocconeis Pediculus.</i>	<i>P. oblonga.</i>
<i>Cymbella capitata.</i>	<i>P. radiosa.</i>
<i>Cymatopleura elliptica.</i>	<i>P. stauroneiformis.</i>
<i>C. Solea.</i>	<i>P. viridis.</i>
<i>Diatoma vulgare.</i>	<i>P. viridula.</i>
<i>Gomphonera acuminatum.</i>	<i>Pleurosigma attenuatum.</i>
<i>G. constrictum.</i>	<i>Stauroneis gracilis.</i>
<i>Himantidium pectinale.</i>	<i>S. linearis.</i>
<i>Melosira varians.</i>	<i>Surirella biseriata.</i>
<i>Navicula affinis.</i>	<i>Synedra radians.</i>
<i>N. amphirhyncus.</i>	<i>S. capitata.</i>
<i>N. cuspidata.</i>	<i>Tabellaria flocculosa.</i>
<i>N. firma.</i>	<i>Triblionella angustata.</i>
<i>N. gibberula.</i>	

[All the above were taken from the Pool, named, mounted, and exhibited on the spot by Dr. Bossey.]

He also illustrated the Botany of the neighbourhood by showing a large number of flowers gathered in the locality. From the Silent Pool the party walked to Black Heath, lying about half-way between Gomshall and Chilworth. The miserable condition of the foliage of the Oaks in this part of the county was very remarkable; everywhere they showed traces of the severe gale of April 29th; nearly all were almost bare or only scantily furnished with leaves; they seemed to have suffered more than was the case a little further eastward. In a wood by the road-side the Garden Warbler was heard singing, and Stonechats were seen on Black Heath. *Potentilla argentea* was gathered on the railway-bank. The party walked to Chilworth Station, having had a most enjoyable day, fine and hot, but tempered by a delightful breeze; it was enjoyed all the more from occurring in the midst of a period of much rain.

NORBURY PARK. — July 8. (Conductor, Mr. J. J. Gill). Starting from Box Hill Station of the South Eastern Railway, the party walked along the road skirting the base of Box Hill as far as Burford Bridge Station of the London, Brighton and South Coast Railway. Here, through their want of familiarity with the country, and the fact that the nominal leader of the party had only once before been over the ground,—and that not on foot,—they took the wrong road, and were led some miles out of their way; but this circumstance was not in the least detrimental to the enjoyment of the excursion, as the road taken led to some very pretty scenery, and Norbury Park was at last reached by a very enjoyable walk over some wooded downs that brought them to one of the farther entrances of the Park. Arrived there, the party directed their steps to the Hall, the residence of Thomas D. Grissell, Esq. From this point, which is on very high ground, and also from a position a little lower down beyond the Hall, some splendid views are to be obtained of the surrounding country, including the village and downs of Mickleham and the valley of the Mole on one side, and a wide stretch of country towards London on the other. Amongst the objects visible in the latter direction the

Houses of Parliament can be seen on clear days, and the view is bounded by the hills beyond London, probably the Chilterns. From the Hall the party walked through the Park to the Druids' Grove, on the Dorking side of the Hall. Here, as well as in the Park itself, are some magnificent trees, the most striking being many remarkably fine Beeches, some of them veritable giants of the vegetable world; and in the Druids' Grove a great profusion of very old Yew-trees. Amongst the botanical specimens met with on the excursion may be mentioned:—Dropwort (*Spiræa Filipendula*), in considerable abundance in the Park; Basil Thyme (*Calamintha acinos*), Dark Mullein (*Verbascum nigrum*), Lesser Broomrape (*Orobanche minor*), Ground Pine (*Ajuga Chamæpitys*), the last two growing in some profusion in one large fallow-field at the foot of the Downs; and Dwarf Mallow (*Malva rotundifolia*), on the road-side near Burford Bridge.

GODSTONE, WOLDINGHAM, &c. — July 22. (Conductor, Mr. A. J. Crosfield). Members met at Godstone Station, and took the road northward through the village of Godstone, ascending the Downs to the N.E. of the village to an elevation of 820 feet in the neighbourhood of Woldingham. By the road-side between Godstone Station and village *Trifolium medium* and *Lysimachia nummularia* were gathered. On the Downs we met with *Campanula glomerata*, *Spiræa Filipendula*, *Verbascum Thapsus*, and other species of plants characteristic of our chalk-hills. *Brachypodium sylvaticum* and *Festuca gigantea* abounded in the hedgerows. Woldingham Church is one of the smallest in the kingdom, and the situation is very bleak; a very old Yew and Ash tree stand in the churchyard. Coming down into the valley, and crossing the new line of railway from Croydon to East Grinstead, a very slippery path with preserves on either hand brought us to Marden Park; and following the course of the valley, a walk of nearly three miles further took us to Warlingham Station, on the Caterham Valley Railway.

GODSTONE STONE-QUARRIES. — August 12. (Conductor, Mr. W. Gilford). The members met at Redhill Junction, and proceeded to Godstone station, which is on the Weald Clay.

Turning in a westerly direction alongside the railway, they came into the direct road to Tilburstow Hill, leading north. After proceeding for some distance on the fresh-water deposit of the Weald Clay, the cottages on the eastern side were passed, above which the lowest beds of the marine series were reached. The Atherfield Clay has here a very narrow outcrop of only a few feet wide. Reaching the higher ground beyond, the Hythe Beds of the Lower Greensand were attested by a great change in the character of the vegetation and of the soil on the banks; still rising, they at length nearly reached the summit of Tilburstow Hill, which escarpment is formed by the rise of the stony beds of the Hythe series. Turning into a narrow cart-track through a gate, the party were conducted to a quarry in the Hythe Beds, which are here thrown up to about 45° , the ordinary dip being only about 7° . The Hythe Beds here consist of sand, rubbly beds of sand and chert, ferruginous sandstone, and chert, the last being quarried for road material. The upper portion of the section in the quarry consists of Sandgate Beds. A little further on, and at the summit of the hill, a sand-pit by the road-side shows a fine section of the Sandgate Beds: the lowest part much resembled the silver-sand of the Folkestone Beds, and might have been mistaken for that deposit were it not for its subordinate position in the section. The Sandgate Beds here and in the Quarry appear to be an outlier covering the Hythe Beds, where they are raised to such an unusual inclination. A little lower on the north side of the hill the Hythe Beds appear to subside into their ordinary dip, and the Sandgate Beds are not found until nearly at the foot of the hill, where they occur at the main outcrop; this outcrop trends in a S.W. direction, and reaches the crest of the same range of hills nearer Bletchingley, occupying the summit to Redhill. The outlier on Tilburstow Hill probably continues on the crest westwards until it reaches the outcrop. The tendency of the oxide of iron to separate from the sand into thin horizontal or curved strata, or into box-stones—as noticeable in the Folkestone Beds at the sand-pit on Redhill Common, and in the section of the

Sandgate Beds at the junction of the Bridge and Ridgeway Roads, opposite the Lodge at Eastcote—is observable at Tilburstow Hill. A search for a good standpoint on the height, where there would be no timber to obstruct the view, resulted in the members collecting on a plateau above the sand-pit; a wide sweep of most beautiful landscape-scenery was commanded on every side, embracing all the various geological formations of the Cretaceous and Wealden systems. The northern background consisted of the lofty heights of the chalk escarpment, abutting against which was seen the gentle terrace of the Upper Greensand; lower down the valley came the oak-dotted plain of the Gault, and nearer still the broad level of the Folkestone series of the Lower Greensand, on which the picturesque village of Godstone is a conspicuous feature; then in a slight depression at the foot of Tilburstow Hill there might be seen the narrow outcrop of the Sandgate Beds, the rising ground nearly to the point of observation being occupied by the Hythe Beds, an outlier of the Sandgate Beds, forming the crest on which the members stood. Then turning southwards at the foot of the escarpment of the Hythe Beds could be seen the low, flat, profusely-wooded plain of Weald Clay stretching away into the distance, beyond which were noticed the rising grounds and heights of the forest ridge, the nearer and lower of which are the Balcombe and Moner's Hill elevation of the Tunbridge Wells Sand; the loftier heights beyond being those of Ashdown Forest and Crowborough Beacon of the Ashdown Sand formation, and in the dim distance rose the chalk escarpment of the South Downs. From the summit of Tilburstow Hill, therefore, the members had in view the whole series of formations of the Wealden valley of upheaval from its northern boundary, the chalk escarpment, to its centre, the forest ridge anticlinal, and also the complement to the view in the distant rise of the southernmost boundary of those formations on the further side of the forest ridge. With a lingering look at the delightful prospect the members descended northwards, observing on their way down an exposure of the Hythe Beds in a ravine or old disused roadway which runs alongside the

present road, the greater part of the way down the hill. At the foot of the hill the outcrop of the Sandgate Beds was traversed and a head-water of the Medway crossed. Half-way up the gentle rise on the other side the Folkestone Beds commence. The party shortly reached the ancient hostelry at Godstone, where, after brief but welcome rest and a light refreshment, progress was made still north to the caves in the silver-sand of the Folkestone Beds, where some time was pleasantly spent in the cool labyrinthine recesses; emerging from which the members proceeded to a delph in the Gault, a little north of the Westerham Road at Tylor's Green, where nodules of phosphate of lime or coprolites were found, and several fossils (some coated with phosphatic matter), principally *Ammonites interruptus*, *A. varians*, *A. tuberculatus*, *Inoceramus sulcatus*, *Hamites* and *Belemnites*, &c., such as are generally found at the base of the Gault. After a few minutes' diligent search amongst the fossiliferous earth, the party hastened to the Firestone Quarries in the Upper Greensand, where two of the principal workmen were waiting to conduct the members; and, being kindly furnished with candles, they were piloted through as large a section of the apparently innumerable ramifications as time could be spared for to allow of the train being caught at Caterham, and the subterranean workings were found something amazing in their vast extent; spacious passages opened out here and there into wide halls, whence other cavernous passages radiated in all directions. These workings are very ancient, and are not inappropriately designated "catacombs." They are of such vast extent that it would take half a day to explore the whole. The workings in the main follow the dip about 7° . The conductors explained the method of working the stone, which is chiselled out in huge slabs, and used for fire-places, furnaces, and a great deal is used for building-stone. It is soft in the quarry, and is then worked with comparative ease, but becomes very hard after exposure. It is of a calcareo-siliceous nature, and appears to be found here in a bed six feet in thickness, lying on a bed of harder nature, closer and more of a limestone, to about eighteen inches

thick, there being also a similar bed immediately above the freestone which forms the roof of the quarry, and a similar layer of hard rock divides the hearthstone above into two beds; it is always called "roofing-stone," and a stone somewhat resembling it is found in the Coal measures, and is there also known as "roofing-stone." The fossil most frequently found in the freestone in this district is a fossil sponge "*Siphonia*."

EWHRUST MILL. — August 26. (Conductor, Mr. A. C. Sterry). The members met on this occasion at Gomshall Station, and proceeded by field-paths and lanes to the village of Peaslake, after passing through which a path was taken up the valley leading direct to Ewhurst Mill. Here the profusion of flowers of the Heather, &c., such as is rarely seen, made the sides of the hill in some places to be one blaze of purple. Continuing the greater part of the way through a Pine-forest, we arrived at the top of Conyhurst Hill, opposite the Mill, at noon, just as the sun shining on the sea beyond Shoreham Gap makes it from this point distinctly visible. The gorse on the sides of the hill had been burnt, leaving only the dead stems, on which were a quantity of a curious fungus (*Hypoxylon concentricum*), sections of which were shown by Dr. Bossey at the Annual Meeting. The return was not by the prettiest route, through taking a wrong road, and a drenching rain did not improve matters; but all were nearly dried again by the sun before reaching Black Heath. The lane leading from Black Heath to Chilworth Station is cut through the sand, giving a fine view of the layers of ironstone occurring in the Lower Greensand; they are here curved and twisted in every direction, and so much so that it is almost impossible to conceive how they can have been formed. The return journey from Chilworth Station ended a pleasant, though somewhat uneventful day. Amongst the flowers and plants met with may be mentioned—*Sium angustifolium*, in the bog near Gomshall Station; and *Asplenium Adiantum-nigrum*, found in abundance on the way home before reaching the bottom of the hill.

BLETCHINGLEY. — September 9. (Conductor, Mr. W. H. Tyndall). The members of the Club met at 2.30 to walk to

Nutfield and Bletchingley. The members assembled at Mill Street, near the arch of the Brighton Railway, proceeding down Mill Street to the brook here crossed by a bridge; this stream is one of the sources of the River Mole, the most northern and most eastern of the feeders; it drains the valley lying between the Chalk range and the Lower Greensand range. This valley extends from north to south about two miles, and from east to west about four miles; and the brook is the only outlet for the drainage of that district. There are evidences that at no very distant period the lower part of the valley was frequently under water, and it is exceedingly probable that at some more distant time it was the bed of a lake. A superficial clay is found lying on the Gault Clay, forming the substratum of a considerable part of the valley, and covering also on its south side the Lower Greensand formation; of this superficial bed of clay, bricks are largely made. Leaving the brook, and passing under the South Eastern Railway, the road ascends the south side of the Lower Greensand range. Here we note one of the deep sandy lanes which abound in the Greensand series, and which form a very picturesque feature in the scenery of the neighbourhood and of this geological series wherever it extends. No satisfactory explanation has been given, so far as the writer knows, as to the formation of these deep lanes, often rocky as well as sandy; that they are partly water-worn is probable from the fact that in most cases the roadway is not a gradual incline, but is much steeper in the middle of the ascent than towards the top or near the bottom. It seems as if a rush of water had swept the loose soil from the upper part, the current being stronger about midway, and deposited the soil at the bottom, so lessening there the sharpness of the descent. After quitting the deep lane, the road runs eastwards on the side of the hill, the view south being very extensive and beautiful, overlooking the Weald, and reaching to the line of hills once covered with extensive forests, of which remains exist in Ashdown, Tilgate, and St. Leonard's Forests. Continuing east, the road descends somewhat to a level of the Wealden, but on the left or north of the road the

Greensand hill is formed into beautiful undulations, which have been taken advantage of in forming the grounds of Mr. Joshua Fielden, M.P., whose house, situated on the top of the range, overlooks the varied outline of the hill below and the distant prospect beyond. The lane becomes narrow, ascending again one of the water-worn ways. On the right bank the Periwinkle (*Vinca minor*) abounds. Some tall specimens of grass were gathered, about six feet in height. The lane here formerly abounded in Primroses, but many have disappeared, gatherers from London having probably filled their baskets for sale. Nearly in front eastward is a conical hill, a kind of offshoot from the general range of the Greensand series, parallel with the escarpment of which the path has hitherto led. We descend now to a little collection of houses and a lane called Mid Street, which lane we cross and enter into a field, ascending the hill on the opposite side. This field, lying between two steep hills east and west, and at the foot of the main range to the north, receives over a very narrow extent the drainage of the valley, and is particularly wet and often flooded in winter. The bank which hitherto rose on the left hand or north side of the path having been passed, the way led through a field by the side of a steep declivity on the north side, looking like a slip or fault in the rock. The path again descended to nearly the foot of the Sand range. Two large blocks of stone were passed, lying in a field near the path; the stone is of a different character to the local rock, and seemed allied to the Tunbridge Wells rocks; they were not near any building, and what their use might be could not be determined; the larger stone was 4 ft. by 2 ft. by 3 ft. At the foot of the hills we crossed a wet meadow, and turning north ascended to the top of the hill into the village of Bletchingley. At one period it must have been a place of importance; it possessed several churches and a castle, of which only some of the foundation-walls remain. The town sent two members to Parliament until the Reform Bill, when it was disfranchised, suffering the fate of its neighbour, Gatton. On the site of Bletchingley Castle stands a handsome modern house, belonging to Mr. Norris. Just outside the

grounds surrounding Mr. Norris's house, and on the very brow of the hill, enjoying a most extensive and varied prospect, a path runs in a homeward direction; this path was doubtless originally just outside the castle-walls, and continues for a considerable distance on the brow, then suddenly descends into the valley through a narrow copse. Proceeding for a short distance along the high road towards Redhill, the members arrived at the path leading down the north slope of the Sand range, towards the vicarage of Nutfield. As a general rule, the land for agricultural purposes is better on the north slope of the hill than on the south. The escarpment or steep side lies towards the south, the more gradual descent towards the north, taking in fact the same direction or dip as the chalk takes. And this dip of the strata is common throughout the whole length of its northern range, from near Folkestone in the east to Godalming in the west; and as the Greensand series curves round to the south at its west boundary, and afterwards runs eastwards again parallel to the South Downs, the inclination of the strata is always towards the Chalk, so that ultimately the escarpment of the south range faces the escarpment of the north range. But little of interest was observed in the walk home from Nutfield across cultivated fields. Nearer Redhill may be observed one of the feeders of the brook noticed at the beginning of the excursion; some very marshy land lies along its borders, where in spring may be gathered fine specimens of the Marsh Marigold (*Caltha palustris*).

TILGATE FOREST.—September 23. The party assembled at Three Bridges Station about 9 a.m., the conductor being Mr. Joseph Cheal, of Lowfield Nurseries, Crawley, who had kindly obtained leave from the owners of property in Tilgate Forest for the party to go over their land. A walk of about three-quarters of a mile brought us to the borders of the Forest, the timber of which is chiefly Oak, though not of large size. In some parts of the Forest many trees of the Turkey or Levant Oak (*Quercus Cerris*) were observed. Fungi were growing in profusion, the *Boleti* being especially abundant, including *B. scaber*, *B. chrysenteron*, *B. granulatus*, *B.*

flavus, and others which were not identified. Many of the brilliantly-coloured *Russulas* were also found; and *Lactarius deliciosus*, recognisable by its bright orange milk, and colour changing to green when bruised; *L. torminosus*, and *L. quietus*. The curious, almost spherical *Scleroderma vulgare* was also met with, hard and intensely black within, and with a strong disagreeable odour. Amongst the plants characteristic of the Forest are—*Campanula hederacea*, which grows abundantly in most parts; *Scutellaria minor*, found almost everywhere; *Narthecium ossifragum*, growing by one of the large hammer-ponds; *Hypericum elodes*, in marshy places; *Anagallis tenella*, often found growing with *Campanula hederacea*, but much less common. Ferns are very abundant, especially *Lastrea dilatata*, *L. Oreopteris*, *Athyrium Filix-femina*, *Aspidium Filix-mas*, and *Blechnum boreale*, all of which species luxuriate in the localities respectively suited to them. Comparatively few birds were observed: two flocks of Wild Ducks, or perhaps the same seen twice, were flying round some of the ponds or swimming among the water-plants; they consisted of about twelve birds each—doubtless the pair of old birds and their brood hatched early in the year. The cry of the Green Woodpecker and Jay were heard occasionally, and an individual of the latter species was seen. The party walked for several miles through the wooded parts of the Forest, in a south or south-westerly direction, and on emerging from the woods turned east, and soon after crossed the railway not far from the north end of the Balcombe Tunnel. Passing along a sort of rough track in places somewhat boggy, the minute and delicate little plant *Cicendia filiformis* was discovered growing abundantly in wet parts, extending about fifteen yards along the path; this is a rare plant in our district, and Tilgate Forest is our only recorded locality; so extremely small a plant may, however, be very easily overlooked. A quarry was passed where the Hastings Sand appeared in the form of beds of soft friable sandstone; small blocks had been quarried for use in making paths in gardens and similar purposes, not being hard enough for building purposes. In one of these blocks a cast of a *Paludina* was noticed. By the

roadside further on *Hypericum Androsæmum* was found, and along a hedge in the field adjoining Three Bridges Station *Serratula tinctoria* was in flower in abundance. We were favoured with splendid weather and bright sunshine, scarcely interrupted by a cloud throughout the day.

ANNUAL MEETING.—OCTOBER 12TH, 1883.

The following Annual Report was presented and read:—

HOLMESDALE NATURAL HISTORY CLUB.

Annual Report, October 12th, 1883.

During the past year ten new members and three subscribers have been elected into the Club; five have left the Club by resignation, and two by death; the present membership is eighty-two.

The Evening Meetings have been held monthly during the winter, and the following subjects have been introduced, in most cases in the form of papers, several of which were illustrated by specimens and diagrams:—

Oct. 20, 1882. 'Plants of the Natural Order *Leguminiferae*,' by Mr. A. J. Crosfield.

Nov. 10. 'Presidential Address'; subject, "Physical Geography," by Mr. W. H. Tyndall.

Nov. 10. 'Character, as one of the Causes of the Rarity or Abundance of Different Species of Birds,' by Mr. H. M. Wallis (Reading).

Dec. 8. 'Bird-Life of the Bass Rock and the Farne Islands,' by Mr. E. Bidwell (London).

Jan. 12, 1883. 'The *Saprolegna Ferox*,' by Mr. H. Boyle, M.A. (Clapham).

Feb. 2. 'The Migrations of Birds,' by Mr. J. E. Littleboy (Watford).

Mar. 9. 'Geology Made Easy,' by Rev. H. Brass, M.A., F.G.S.

April 13. 'Meteorological Notes for 1882,' by Mr. W. H. Tyndall.

The Secretary read Reports presented by various Conductors of Excursions during last summer.

Most of the Evening Meetings have been fairly well attended, the one held in March specially for pupils in the schools and other young persons in the neighbourhood particularly so. At this meeting the Rev. Henry Brass delivered a lecture of an elementary character on the subject of Geology, with especial reference to the geological structure of our own district; the lecture was well illustrated by diagrams and maps, and a large collection of fossils, &c., chiefly from the various strata of the neighbourhood. Many other members contributed microscopes, Natural History collections, and other objects, which added greatly to the interest of the meeting.

OUTDOOR MEETINGS.—Eleven Excursions have taken place during the summer, as follows:—

Whole day.

- April 21. Cæsar's Camp, on Dry Hill.
- May 19. Limpsfield and Botley Hill.
- June 16. West Hoathly and Balcombe.
- July 21. Hindhead and Devil's Punch Bowl.
- Aug. 25. Kew Gardens.
- Sept. 22. Leith Hill.

Afternoon.

- May 5. Reigate Hill and Betchworth.
- June 2. Deepdene, Dorking.
- July 7. Betchworth and Mickleham.
- Aug. 11. Gatton Park.
- Sept. 8. Marden Park and Caterham.

DONATIONS, &c. — Mr. Sydney Webb, of Dover, a former President of this Club, has presented a manuscript list of the Fossils in his collection and that of Mr. C. Upton, arranged in their respective classes; as nearly all these were found in this neighbourhood, the list, which names all the localities and the nature of the strata where found, may be of great value to local collectors. Mr. T. P. Newman has offered to

present to the Club a monthly copy of the 'Journal of Botany.' Mr. Richard Noakes has presented a collection of Mosses.

EXHIBITS, RECORDS, &c. — A Goosander is reported as seen on Gatton Lake, by Mr. J. H. Gurney, jun., of Norwich.

Botany.—Mr. A. J. Crosfield exhibited at one of the Club's meetings specimens of the following rare plants found by him during the preceding summer:—*Gallinsoya parviflora*, a South American plant naturalised in neighbourhood of Kew; *Campanula persicifolia*, from a valley north of Box Hill; *Verbascum lychnitis*, near Sanderstead; *Orobis tuberosus*, var. *tenuifolius*, Addington Hills, near Croydon.

Mr. W. H. Summers, of Dorking, sent a specimen of *Hordeum sylvaticum*,² a plant not mentioned in Brewer's 'Flora,' found near Raunmore Common. *Orchis ustulata* has been found on Reigate Hill (by Mr. John Linnell and others). A specimen of double-flowered Anemone was found by Miss Hogben on one of the excursions, between Reigate Hill and Betchworth.

A living specimen of the old English Rat (*Mus rattus*) was exhibited at one of the meetings of the Club by the Hon. Sec. (Mr. J. J. Gill).

A Prize was offered by Mr. W. Gilford for the best geological collection, and two prizes by the Club for the best botanical collections. The geological prize was not competed for, and only one botanical collection was sent in, viz., one by Mr. K. Peters illustrating fifty-three Natural Orders, for which a prize of £1 was awarded him by the Committee.

METEOROLOGY. — Mr. W. H. Tyndall presented his usual tables and notes for the past year. The most interesting feature of his report was an account of the tremendous gale of April 28th and 29th, when sea-spray appears to have been carried over a great extent of country, and was distinctly perceptible at Redhill, the windows facing south being encrusted with salt, and young leaves and blossoms destroyed either by the cutting force of the gale or the salt spray that it bore. A very fine Aurora on November 17th and a remarkable sunrise on February 18th were also reported.

The Treasurer's Balance Sheet, duly audited, was presented and read, as follows:—

Receipts.			Expenditure.		
	£	s. d.		£	s. d.
Subscriptions received ..	34	11 0	Balance due to Treasurer,		
Donations from various			Oct., 1882	0	14 1
members	24	3 0	Rent of Museum, Gas, and		
Sale of copies of 'Proceed-			Firing (1 year to June		
ings'	0	12 6	20, 1883)	15	17 7
			Assistant Curator (½ year's		
			salary)	3	5 0
			Printing, Stationery, &c. .	2	9 1
			'Zoologist' (9 months) ..	0	9 0
			Mrs. Joyes (cleaning, &c.,		
			1 year to Dec., 1882) ..	1	2 0
			Botanical Prize	1	0 0
			Marshall (Chemist)	0	5 0
			Collector's Expenses, Post-		
			age, &c.	0	6 0
			Collector's Commission ..	1	7 6
			Balance in hand	32	11 3
	£59	6 6		£59	6 6

Audited and found correct.. { FRANCIS BOSSEY.
ALBERT J. CROSFIELD.

The following gentlemen were elected as the Officers of the Club for the ensuing year:—*President*, Mr. W. H. Tyndall; *Treasurer*, Mr. R. C. Baxter; *Secretary*, Mr. A. J. Crosfield; *Curator*, Mr. J. Linnell; *Committee*, Dr. Bossey, Messrs. T. Cooper, T. L. Aspland, J. B. Crosfield, T. P. Newman, H. W. Gilbert, J. J. Gill, R. Noakes, and Lieut.-Col. Godwin-Austen, F.R.S.

Dr. Bossey exhibited under the microscope specimens of *Nitella flexilis*, Agardh, found at Hindhead.

Mr. N. E. Brown, of Kew Herbarium, exhibited a living specimen of *Chara Braunii*, Gmelin, and also a coloured drawing of the same, showing some of the parts magnified, which he had prepared for the new edition of Sowerby's 'English Botany' now in course of preparation.

Mr. J. J. Gill exhibited a number of plants collected in the neighbourhood of Maidstone by Mr. K. Peters; these included *Scirpus maritimus* and *Statice limonium* from the salt-marshes at Cuxton; and *Paris quadrifolia*, *Orchis fusca*, &c., from Maidstone.

A paper was read by Mr. W. H. Summers on 'The Orchids of Surrey.' In the course of his remarks Mr. Summers described twenty-eight species of *Orchidaceæ* said to have been found in Surrey.

EVENING MEETING.—NOVEMBER 9TH, 1883.

The President, Mr. W. H. Tyndall, delivered a short inaugural address, in the course of which he said that he thought the subjects discussed at our meetings might be of great use and lasting benefit. Science had helped and benefited mankind to an enormous extent of late years. Electricity began with very small beginnings and experiments of an almost trivial nature, but it had been worked out and developed into a science of vast importance. Botany, Geology, Meteorology, and other sciences had all been of almost boundless value, and the scientific quest upon which our society was bound might be of great benefit both to ourselves and others if properly pursued.

The following paper was then read by Mr. Edward Lovett, of Croydon, on 'The Habits of the Stalk-Eyed Crustacea of the British Islands':—

Perhaps no one class of animals is so comparatively little known to the public and so scantily studied by naturalists as the Crustacea. Why this is it is difficult to say, but certain it is that there are few works written upon this subject, whilst there are almost libraries referring to Mammals, Insects, and even Mollusca; and Bell, the recognised authority up to the present, describes as exceedingly rare, specimens that are simply local, and even figures in his appendix others that one would have thought his keen observation would have brought to light before he finished the bulk of his volume. There are, moreover, many species not mentioned by him at all which are by no means rare, for I have myself examined over one hundred specimens of *Stenorhynchus Ægyptius* taken by one boat in the Channel, and hitherto considered a Mediterranean form.

From this I have no doubt at all that if the seas around

our coast could be well worked, not only would many rare species be found in abundance, but that others would be taken which may now be considered as foreign to our shores. There is, however, no subject more interesting than the study of these remarkable animals; and as so many of them serve as articles of food, it is no doubt most probable that they will receive more attention from naturalists than they have done hitherto, especially as greater facilities are now offered for obtaining specimens, and a means found not only to preserve their exoskeletons satisfactorily, but even to make them an attractive object for the cabinet.

During my comparatively short acquaintance with the Crustacea, confined, I regret to say, almost entirely to the South Coast and the Channel Islands, I have observed many interesting features regarding them, which may prove attractive, and which I have gathered together for my remarks this evening.

Without going into any sort of description of the Decapod Crustaceæ, it is as well to mention that they are subdivided into three very distinct and easily recognised tribes, *viz.*, the *Macroura* or lobster form, embracing the Lobster, Prawn, Shrimp, &c.; the *Brachyura* or true Crab form, of which our Edible Crab and Shore Crab are types; and an intermediate tribe, the *Anomoura*, embracing what at first sight appear to be true Crabs and true Lobsters, but having this remarkable characteristic—that they have only eight true legs, the fifth pair being rudimentary. This tribe includes the Galatheas, the Stone Crabs, and all the Hermits or Soldier Crabs.

Now, taking the *Macroura* or Lobster form first, I will not waste time with those with which we are all familiar, beyond mentioning that two years ago I was sent for to see and describe a very curious specimen of the common Lobster. It was of a beautiful pink colour, with light red antennæ; and as it was alive and vigorous when I examined it, there was no doubt as to its being the right colour of the animal, which I consider to have been an albino. There was for some time in the tank at the Royal Aquarium a fine old Lobster of a pale slaty-blue colour, but this variety is not so rare.

In Jersey occurs a curious family of boring Lobsters. These are called respectively *Axius stirhynchus*, *Gebia deltura*, and *Callianassa subterranea*. They are seldom found above ground, but live in long tunnels in the sand or rock *detritus*. It is remarkable that these species can only be obtained by digging rapidly into the spot where there is indication of a burrow, on the very edge of the rising tide; in fact it is a rule with all burrowing Crustaceans and Mollusca that they go deep as the tide ebbs, and rise to the surface of the sand-beds when it flows; and this is a good guide to the shore-hunter, who may be too busily engaged to watch the turn of the tide; for I can speak for the coast of Jersey that when these little burrowers begin to disturb the smooth surface of the sand it is time to make tracks.

These burrowing forms are armed with broad, massive claws, and it is wonderful in how short a space of time they can put themselves out of sight if placed on the wet sand. There is another little group of rare crustaceans of this tribe found in the luxuriant rock-pools of Jersey, comprising *Athanas nitescens* and the *Hippolytes*. These are lovely little things about three-quarters of an inch in length, and of a most gorgeous green and red. They live amongst the brilliantly coloured *Algæ*, and are wonderfully protected by their resemblance to them in tint.

Going from the tropical rock-pools of Jersey to the muddy estuary of the Thames we find some very interesting forms. One, *Pandalus annulicornis*, is known as the Thames Red Shrimp, and is the one sold on the Gravesend boats. It is not a Shrimp at all, but allied to the Prawns. It is a rapacious fellow, and goes up the river on the tide; and I daresay if his admirers only knew what he devoured they would not enjoy the dainty relish he affords when boiled. Another allied species, *Palæmon varians*, popularly known as the Bunter, lives in the brackish-water ditches adjoining the mouth of the river. It is a fairy-like form, and a favourite food of many fish.

I once saw a curious and fatal accident to a Shrimp, which was caused entirely by its structure. The spines and points

of these animals all point forwards, and this unfortunate Shrimp had backed himself into the tapering tube of an annelid. Of course he got in easily enough, but his spines prevented his ever getting out again; and as he could not get out through the small end he died, and so I found him a monument of an unfortunate development.

With the fresh-water Crayfish, Huxley's admirable work deals most exhaustively, but, as I have caught some hundreds of them, I will just refer to one or two points about them. Their favourite haunts are watercourses, brooks, &c., in the calcareous clay of a limestone district—such as near the source of the Thames, for instance; and the chief method of catching them is by means of small circular nets stretched on iron rings, and baited with liver; but I have just heard of a curious mode of catching them, which shows *Astacus fluviatilis* to be endowed with a certain amount of intelligence, sufficient in fact to prove fatal to it, and no more. My friend caught fifty-three Crayfish by angling, as follows:—He baited a hook with a worm, and dropped this just before a Crayfish as it was walking along the bed of the stream; it seized the line with its claws and proceeded to devour the bait, and the more it was pulled along the tighter the Crayfish held on, and so was easily landed.

We will now pass on to the true Crabs, and here we find a large number of families with remarkably divergent habits. There is one large family, the *Portunidae*, embracing several genera having the fifth pair of legs terminating in regular paddles. These are called the Swimming Crabs, though I do not think that any of them absolutely live free in the water, like fishes. I believe they certainly do take short swims; and one species, *Polybius Henslowii*, must indulge in rather long ones occasionally, for it is frequently taken in Herring-nets. The largest swimming Crab, *Portunus puber*, is a gorgeous species when living, and is exceedingly delicate as an article of food, surpassing even the recognised Edible Crab. It is not common enough and does not grow large enough on our own shores to be used as food, but in Jersey it abounds. It is worthy of note that all the group, owing to their active

habits, never become encrusted with sponges, zoophytes, &c., as do some others that we shall notice presently. The proverb that "a rolling stone gathers no moss" is wonderfully well verified in their case.

As a contrast to this beautiful and lively family we will now turn to one of a directly opposite nature, namely, the *Maiadæ*, embracing three of the largest genera to be found anywhere. The genus *Pisa* contains two species, *P. tetraodon* and *Gibbsii*, both of which are liable to the growth of zoophytes, Algæ, &c.; but the latter, owing to its hairy carapace, is particularly so liable, being often found perfectly hidden by a sponge growing upon its back. No doubt thousands are killed by these sponges, for I once found one (dredged up) which had only its mouth-organs, eyes, and one leg left free, so closely had its parasitical sponge insinuated itself, and yet it was alive so far. I have obtained a very fair series of growths on the backs of these remarkably sluggish animals.

Another member of this family, *Maia squinado*, is covered with spines, which are generally to be noticed in old specimens as having been rubbed down. This is owing to the animal's habit of living in rock-crevices, into which he forces himself, to the destruction of his spiny armour. This species, which grows as large as a cocoa-nut, is eaten in the Channel Islands, where it is much esteemed, and cheap withal.

Closely allied to these genera are the beautiful little Spider Crabs, *Stenorhynchus*, *Achæus*, and *Juachus*. Of these the rarest is *Achæus Cranchii*, a crustacean not much bigger than and very like our long-legged Garden Spider. This curious little species is often covered with bits of Algæ, giving him a ragged and untidy appearance. *Stenorhynchus longirostris* is a graceful species, having a tapering body about the size of a small nut, and delicate legs covering a space of from six to eight inches in many instances. These are rather deep-water species, and seem to be a favourite article of food for various fishes.

Going from a species of delicate and fragile structure living in the quiet depths of the sea to one of massive form inhabiting the shore about half-tide mark, where the roaring

breakers hurl the granite pebbles wildly about, we have *Xantho florida*, a stoutly built crustacean that might almost be stepped upon without injury. Its home is in the rocky crannies, where it lives quietly with its less common co-species, *Xantho rivulosa*.

Another curious form is *Corystes Cassivelaunus*, or Masked Crab, the gastric impression on its thorax somewhat resembling a human face, though certainly a grotesque one. This crustacean possesses long pectinated antennæ, much resembling some of the Lepidoptera in this respect. Its habits are interesting; it burrows in the sand at the bottom of shallow water, leaving its eyes and antennæ exposed, and pounces out upon its prey as it happens to come near it.

Gonoplax angulata and *Atelecyclus heterodon* are deep-water species, and moreover rare, so that their life-history is but little known; but *Planes linnaana*, though included as British, is an illustration of geographical distribution by means of ocean currents and floating bodies. It is essentially a surface or floating species, and finds its way to our southern or western shores on fragments of wreck or such water-logged material; though it is evidently a tropical, or at any rate a Mediterranean, form. The little Pea Crabs, *Pinnotheres pisum* and *P. veterum*, are usually found in the shells of living Mollusca, the former in that of the Oyster and the latter in that of the large *Pinna marina*.

We will now glance at the intermediate tribe, the *Anomoura*, which I have already said embraces both Lobsters and Crabs, but which have the fifth pair of legs rudimentary. The Hermits are an amusing family, for to watch the pranks of the common one, *Pagurus Bernhardus*, in a tank is really quite ludicrous; but they are, moreover, exceedingly interesting. *P. Bernhardus*, though inhabiting the dead shells of several species of Mollusca, seems to affect chiefly that of the common Whelk (*Buccinum undatum*), whilst *P. Prideauxii* is almost invariably found in that of *Trochus magus*, a shell certainly not large enough for its proper protection; and so we find it always in company with an Anemone, *Adamsia palliata*, which seems to afford the Hermit Crab additional cover, so

to speak. We find *P. cuanensis* almost always in the shell of *Murex erinaceus*, and *P. lævis* in that of *Turritella*.

The beautiful *Galathea* are of Lobster-form, flattened and spiny. *G. strigosa* when alive is a gorgeous species, of a rich warm brown, splashed with intense blue. The *Galatheas* progress backwards through the water at a great rate by means of their powerful abdominal muscles. The Porcelain Crabs, *Porcellana platycheles* and *P. longicornis*, are very small, the carapace seldom reaching half an inch across. They cling closely to rocks, the former, being of a dirty colour and granular, selecting *Algæ*, on which it is impossible to detect it; and the latter, which is smooth and highly tinted, selecting clean boulders, to which it bears the appearance of being an excrescence.

Dromia vulgaris is one of our rarest Crustacea, and its habits are but little known. Its appearance when at rest is like that of an Echinoderm; and it, moreover, is subject to sponge-growth, as its habits are evidently exceedingly sluggish.

Lithodes maia, the Northern Stone Crab, is a fine crustacean obtained in deep water off the Northumberland coast. It is bright red in colour, and covered even to the claws with powerful spines. Its pseudo-feet are developed with brushes, which it uses to clean its carapace.

In a subject so wide it is impossible to do more than touch upon the most interesting points in a paper of this kind, and I do not pretend myself to know more than what may be considered as a mere glimpse into the life-history and habits of these remarkable animals. There are, no doubt, difficulties in the way of watching them in life, but I hope when the day arrives when large public aquaria can either be supported or made to support themselves, that not only naturalists, but everybody—for everybody ought to be naturalists—will be able to watch these and numerous other sub-orders, and gain some knowledge regarding them; for it is certain that we know very little about marine-life of any kind at the present moment.

In the discussion which followed, the President, Lieut.-Col. Godwin-Austen, and Mr. T. Cooper took part.

EVENING MEETING.—DECEMBER 14TH, 1883.

The thanks of the Club were given to Mr. A. Bennett, of Croydon, for a copy of his pamphlet on ‘*Najas Marina* as a British Plant.’

Dr. Bossey showed under the microscope some *Foraminifera* from the Gault Clay of Wray Common.

The President then read ‘Notes on a Recent Visit to the Isle of Portland.’ He called attention to the tendency of the land in England to run into points tending south and west. Portland is not, strictly speaking, an island, being joined to the mainland by Chesil Bank, a ridge about ten miles long and from a quarter of a mile to a mile in width.

The Isle of Portland is about four miles long from north to south, and a mile and a half broad in its broadest part. In shape it is like an elongated egg. Its greatest elevation above the sea is 495 feet; it rises rapidly on the north, and slopes on its southern end to about thirty or forty feet above the sea. Portland is one vast rock, chiefly of the geological series called Upper Oolite, composed, however, of various strata belonging to that series; it is of marine formation. The rock is removed for building-stone, which is of a very superior character. St. Paul’s Cathedral is built of it, and blocks rejected by Sir Christopher Wren still lie about, none the worse for exposure.

The island rests on a bed of Kimmeridge Clay, so called from a village in Dorsetshire, where it has been found near the surface; this clay is in some places bituminous, and works were at one time erected for the manufacture of oil and paraffin; it has also been, in times of scarcity of coal, used for fuel, but yields disagreeable fumes, and hence the manufactory itself was discontinued. On this foundation of Kimmeridge Clay lies about eighty feet of what is termed Portland Sand, of somewhat ferruginous character; not all loose sand, but sandy rock, with layers of indurated sand. Over this is about forty feet of impure limestone, mixed with chert and flint, the chert sometimes in layers, sometimes in detached pieces; the flint also is not like flint in chalk in

regular layers. Chert does not belong to one geological series only, but seems to be distributed in several.

On this bed of impure limestone lies a bed of rock, called the Base Bed, as forming the base or resting-place of the freestone, known more particularly as Portland Stone. It is a soft and wet stone, not so valuable as the rock resting immediately upon it. Still ascending, we reach the best Portland Stone, which is nearly white when dry, not so fit for outdoor work as the layer above it, but very suitable for indoor work and for statuary. The stone immediately above is that which is most valuable for outdoor building; it is very compact and close-grained; though soft when recently taken from the quarry, it gets very hard on exposure.

Over this lies a bed of stone of extreme hardness, composed almost entirely of Oyster-shells, very useful for rough work, and largely used in forming the breakwater; but not available in Architecture, as it will not take a smooth surface; so hard is the stone that it has to be worked with a pick, like Granite. Above this are a variety of beds of varying depth, some yielding stone of inferior value; the upper beds yielding a stone of shaly nature, which seems to have been used at one time in the island as roofing-stone.

I must not, however, omit one bed of special interest, called the *Dirt Bed*, which abounds with fossil trees, some of considerable magnitude, plainly indicating that at one period of the history of the island it was largely covered by forest; they are almost entirely trees of the Fir tribe; some stumps are left, rising a foot or eighteen inches into the layer next above; the pieces of one of these trees have been put together, extending twenty feet; some pieces I saw two or three feet in diameter, and nearly as high.

There are two dirt beds, but one only contains fossil trees. Very few trees are now found in the island, and, except one small plantation on the east side, it is really bare of trees. The soil is fairly fruitful, being a mixture of clay and lime; it grows good crops of Wheat in the south, and excellent Potatoes. The island being very populous, few wild sea-birds visit it, there being little shore and deep water all round, except at the north and north-east sides.

The Portland Rock abounds in fossils of various kinds. Chesil Bank is of the Kimmeridge Clay, on which the island rests; it is very tenacious, and nearly black. It is an entire barrier to the inland streams reaching the sea, and is of so fine a nature that the waves of the sea have not washed it away; but the action of the sea has heaped on it a bank of shingle, in some places forty feet high, and extending the whole length of ten miles. On the east side of this bank is a stream, called the Fleet, remarkable for the extensive Swanery at its north-west extremity, several hundreds being kept there.

Mr. Horace W. Gilbert then read a paper, entitled 'Remarks on the Marine Life of the Reigate District,' as follows:—

The subject I have chosen was suggested by a recent donation—the boxes of fossils given us by Mr. Allingham, the contents of which I was examining the other day; and on being asked to read a paper at this meeting I thought that a few remarks on the character of our local fossil fauna and flora might prove of some interest. I proposed, therefore, to describe some of the more prominent forms of life which existed at those remote periods when the stratified rocks of our district were in process of formation. But on consideration it struck me that I was restricting myself to a rather narrow subject, and that the paper might be made more interesting—and certainly more intelligible—if I took a broader view of the matter and gave a general sketch of those great principles of Geology which the local formations serve to illustrate; and the order in which I shall proceed will be to first remark on the character of each succeeding formation, and then say something about the fossils contained in it; not confining myself strictly to the fossil beds of Reigate, but, taking them as types, mention the corresponding beds of other British localities, as well as of other countries, and their forms of contemporary life.

First, then, let me remind you of a fact, which I have little doubt that most here know very well, that our district is occupied by at least two formations, the lower deposited by fresh water, called the Wealden system, and an upper one,

formed in seas of greatly varying depth, known as the Cretaceous system.

In considering the formations I have mentioned we will start from the clays forming the floor of the great Weald Valley in our district; then going in a northerly direction we will ascend the range of sand hills, of which Leith Hill, Park Hill, Redstone Hill, and Tilburstow Hill are prominent members; then coming over the valley in which we are now situated, known as Holmesdale, also with its floor of clay, we will lastly make another ascent up the steep escarpment of the chalk, which forms the North Downs.

In considering the clay of the Weald and how it came to be where it is, we must look back a very long time to a period when a great river, only comparable in size to the largest rivers now existing in the tropical parts of our present continents, flowed over the spot now beneath our feet, and emptied its flood of waters by an immense delta into a sea the site of which is now occupied by a large part of the present Continent of Europe.

Being a river, though a large one, we must not expect to find the various sediments which were deposited by its waters so widely spread as those formed at the bottom of an extensive sea; but we know that the surface covered by them was considerable, for we find them extending over a space 200 miles wide from N.W. to S.E., and 320 miles in a direction from W. to E. This area, it has been remarked, does not exceed that occupied by the deltas of some of our existing rivers, as that of the African Niger, which extends 170 miles inland, and occupies a stretch of 300 miles with its many mouths.

In examining the deposits of the Wealden river we obtain evidence not only of the position of the continent which it drained, but at the same time of the character of some of the rocks which composed that continent, for if we go over to the western part of the delta, in France, we find fragments of oolitic rocks which we know from their character to have been derived from the north-west of England. At Cuckfield, in Sussex, we find, too, pebbles of Quartz and Jasper, and we

infer from these facts that the continent which this great river drained, and of which Britain then formed a part, was situated to the north-west in an area now occupied by the North Atlantic Ocean; and that this continent was formed partly of rocks of the Oolitic formation, and probably had highlands where quartzose rocks, such as we now find in Scotland, were largely prevalent.

We know, too, that the climate of this northern continent was very different to what we might have expected, judging from the conditions which exist in this region of the Northern Hemisphere at the present day, for, instead of a temperate climate, the animals and vegetables which flourished give plain evidence of a decidedly hot one. Thus we get among the relics of the vegetable life which grew on the low-lying marshes and slopes of this delta, or were borne down by the waters from the interior of the continent and buried in the sediment, such forms as Palms, Cycads, Pines, Araucarias, Tree Ferns, Pandanus or Screw Pine; and Zamia, a form between the Ferns and Palms, resembling the former in the leaves unrolling, and the latter in their general habit. And wherever we find relics of the vegetable life of that period, one thing strikes us—that the great majority of plants belongs to the Gymnogens, and that there is an utter absence of Exogenous plants, such as our present trees. This is worthy of notice, for we shall see presently that these latter afterwards became very plentiful.

But while our continent supported a rich growth of the vegetation proper to a hot climate, life was not wanting in its waters. Thus we find great masses of the agglomerated shells of Water Snails, *Paludina*, now forming the solid limestone of the Weald clay. Ordinary double-shelled Mollusca or Lamellibranchs, too, lived in these fresh waters, among them species of the genus *Unio*, very like the common freshwater Mussel we now find in the Mole. In some places, possibly pools left by the overflowing waters, the small crustaceans known as *Cypris*, the Water Flea, were so numerous that their shells, embedded in the clay, give to it quite a shaly character—that is, it is easy to split it along

the planes in which these shells lie. Fish, too, of various kinds distorted themselves in the waters, these being of the orders known as Ganoid and Placoid, which include fishes covered by hard bony plates and scales, instead of the horny membranous scales such as we see in the common fishes of our rivers.

But the most interesting animals were the Reptiles, not only by reason of their bulk, but from the peculiarity of their anatomy; and prominent among these was the Iguanodon, whose remains were first found in a pit in Tilgate Forest. This reptile was of prodigious size, some specimens attaining a length of seventy feet, and possessing, as might be expected, a skeleton massive in proportion. But, like most colossal animals, it was probably of a most inoffensive disposition, and a strict vegetarian. But what I wanted particularly to mention was its affinities with another class of Vertebrates, the Birds.

The Reptiles and Birds are grouped together under one section, the "Sauropsida," or animals having a Lizard-like appearance, for these two classes have many characters in common; not that we can at present trace a perfect gradation from one class to the other, but among the Reptiles occur forms aberrant from the normal type, which possess many bird-like characteristics; and in the Birds we also find aberrant forms which tend to merge towards the Reptiles. It is with regard to the first of these cases, the bird-like reptile, that I wish to make a few observations; the other case, the reptile-like bird, I shall treat of presently.

The group of Reptiles to which the Iguanodon belongs is that of the *Deinosauria* (signifying "terrible lizards"), a name which, while it does justice to some of the members composing it who were of carnivorous habits, belies the character of others—such as our present subject, the Iguanodon.

A characteristic of the great majority of the birds is the possession of what we call pneumatic bones, that is, their large bones are hollow, and capable of being filled with air, as they are indirectly connected with the lungs. Most of the *Deinosauria* possess hollow limb-bones, though

this feature is not entirely confined to the order—it occurs in the Crocodile, for instance. Its occurring in such an unwieldy animal as the Iguanodon is worthy of notice, for although in the birds we can understand its object,—that of rendering the heavier parts of the body less dense, for greater ease in flying,—we can hardly divine what use it could have been to this enormous reptile, whose organisation in other respects by no means fitted it for flight; and this therefore shows that it was not a modification made to suit certain habits which it happened to follow in common with the birds. In other respects its skeleton displayed many avian characters, but these, with one exception, I will not enter into now. The exception is this—I dare say you have often noticed the position of a Lizard's legs, sprawled out sideways. The Crocodile, I believe, stands in much the same way, and runs with its feet pointing outwards. Now the Iguanodon possesses an arrangement of the femur or thigh-bone in common with the other Deinosaur, which enabled it to move its hind legs in the same manner as a bird, with the feet directed forwards, the legs moving in the same plane as the body. There is little doubt, too, from the great difference in size between the comparatively feeble fore and the large and massive hind limbs, that this immense reptile not merely raised itself occasionally on its hind legs, but often walked entirely on them alone, towering up among the Palm trees and feeding on their juicy tops. As it had but three toes on the hind foot, it may be imagined that in this upright attitude the footprints which it made in the soft mud of its haunts bore a great resemblance to those of some of our birds in which the hind toe is wanting, and such footprints have been noticed in the Hastings beds of the Wealden formation.

I ought here to mention that, in strata belonging to the Trias, which were deposited a very long time before the Wealden beds, three-toed footprints have been long known. At first they were attributed to birds, but as no bird-bones have been found in the Trias, but many Deinosaurian bones, it is a moot point whether they are not the tracks left by these reptiles when walking about on their hind legs.

But we have now reached the foot of the escarpment of the sand-hills overlooking the Weald, and if we cut a section downwards we should see that lying immediately on the fresh-water clays is another bed of clay containing marine fossils. Among the earlier geologists this was regarded as a most astonishing occurrence, for they could not imagine how a river deposit could become covered by one purely marine; but they were not acquainted at that time with one of the fundamental principles of Geology which the two formations in question, the Wealden and Lower Greensand, illustrate exceedingly well. This principle is Oscillation of the Earth's Crust.

We are now quite familiar with the fact that the Earth's crust is perpetually undergoing an up and down motion, one region sinking, while another, perhaps not far distant from it, is rising; and this up and down motion very rarely takes place spasmodically, but is a process so slow and gentle that it is only by the most careful observations that we can detect that it is going on at the present day. But we see in the accumulation of immense sedimentary deposits proofs that it has been perpetually in action, and it is to this slow sinking of our Wealden continent that we owe the presence of the marine beds now overlying the deposits of our Wealden river, which had accumulated to the thickness of 2000 feet. For this thickness of material to have been deposited it was of course necessary that the delta should have sunk 2000 feet below its original level, and it may be asked—How is it that this great sinking went on without the water getting any deeper? for throughout the whole of the beds we have no evidence of any conditions existing other than those accompanying shallow water, wet marshes, and mud-banks. The reason is obvious: the deposits of sands and muds of the river grew upwards at about the same rate as the land was sinking, until at last, probably from the rate of subsidence becoming more and more rapid, the sea gained on the river and gradually overflowed the land.

We have evidence that the submergence was gradual from the occurrence of oyster-beds here and there in the upper

part of the Weald clay, showing how the sea now and again obtained a footing on the river's domain ; and as time went on we see that each successive border of the continent was covered by the sea which advanced from the south-east, and the deposits became entirely marine. Now the character of these succeeding marine deposits showed that a fight for supremacy was still going on between dry land and ocean, for the Lower Greensand contains pebbles of quartz, jasper, and slate of a similar kind to those brought down by the Wealden river, and these were doubtless derived from the wearing down of this great north-western continent.

There is an important feature displayed throughout these Lower Greensands which ought to be carefully noted. This is what is termed false-bedding. Wherever we see this we may feel sure that the deposits in which it occurs were laid down in a sea which was shallow, and consequently subject to be disturbed by varying currents. In the deposits formed at the bottom of a deep and quiet sea we do not get false bedding, the strata appearing parallel to one another under these circumstances. This false bedding existing throughout the Lower Greensands is evidence of itself that the land was as yet at no great distance. We have other signs that the continent was still in existence by the occurrence of drift-wood of trees, such as we find in the river-deposits. These no doubt grew on the continent and were borne out to sea by the overflowing river, whose mouth had now receded further and further away, and there they floated about till they became water-logged and sank. Bodies of the *Iguanodon*, too, were floated out to sea, for we find their bones buried in the Greensand, as at Maidstone.

I must say a word or two of the reason why the deposits of sand obtained the name of "green sands." We find interspersed throughout certain beds of the formation a large quantity of small rounded particles of an earthy substance of dark green colour. On analysis this is found to contain silica, alumina, and oxide of iron, which, chemically combined together, form the mineral *Glaucinite*. If these particles are examined under the microscope, they are seen to be casts of

the interior of the minute shells secreted by very low forms of animal life, called *Foraminifera*. These forms seem to live either at the surface or the bottom of the sea, and perhaps at intermediate depths. However that may be, their shells, when the animal died, must have accumulated at the bottom. Here the mineral Glauconite infiltrated into the shell, filling it and permeating it to its minutest pores; and after this was accomplished and the mineral had become thoroughly solid, the shell, consisting of carbonate of lime, was dissolved away, leaving the cast. But why the Glauconite came to occupy the chamber vacated by the animal is quite beyond our ken at present. It is one of those cases of a mysterious chemico-physical process, the evidences of which we so often meet with in geological research, and which, together with the problems afforded by the iron pyrites-casts of fossils in the Gault, the flints in chalk, and others of a kindred nature, offer so remunerative a field for a patient investigator, possessed of the requisite leisure, and some knowledge of Chemistry and the natural forces. It is noteworthy that in some parts of the Gulf of Mexico this identical process is going on at the present day, and we know that it has happened before in periods far removed, by the occurrence of Glauconite casts of Foram. shells in the Palæozoic rocks of America and Russia.

With regard to the animal which secreted the shell, I mentioned that it was of very low organisation. Some of you are no doubt acquainted with the *Amæba* of our stagnant ponds, and one can hardly conceive of a simpler form of life than that. It has the appearance of a particle of slightly animated jelly, which consists of protoplasm, the material of primitive living matter. Its only trace of organisation seems to be a difference in the density of the protoplasm of the exterior and interior, the outer layer or *ectosarc* being rather denser than the inner part or *endosarc*, which is more fluid.

Some *Amæbas* possess what is called a contractile vacuole. This appears as a clear round space filled with liquid in the interior of the animal, and as it appears and disappears at regular intervals it seems to act as a kind of pump, and may

have something to do with respiration. In some *Amæbas*, too, a spot may be observed, called the nucleus, but its object is not known. The *Amæba* has the power of elongating parts of its outer layer into blunt kinds of fingers, and by them it obtains its food. If one of these fingers or pseudopodia (false feet) touches anything eatable, it seems to wrap the object up in its jelly, upon which the body comes up and surrounds it completely, the refuse being subsequently pushed out anywhere. I said that the *Amæba* is almost as simply constituted as anything living could be, but the Foram, which may be described as an *Amæba* in a shell, seems to be actually simpler, for they never have a contractile vacuole or nucleus, and it seems a most marvellous thing how they could secrete these complicated shells. Their pseudopodia, instead of being blunt fingers as in the *Amæba*, are fine long threads. Their shells may be of two kinds; the first, in which the threads are all protruded from one large opening; and the second, which is perforated all over like a colander by minute holes, and through these passages the threads are projected; in this latter kind there is a film of protoplasm covering the outside of the shell. The shapes which the Foram. shells assume vary so much that Dr. Carpenter and others have come to the conclusion that it is an impossibility to classify them into genera and species, though they have received distinguishing names.

Probably the commonest fossil in the Lower Greensand is the large Oyster, of which I have brought a specimen. In the lower part of the formation they occur in extensive beds, like the oyster-beds which exist at some little distance from the shore at the present day. It shows the scar where the large adductor muscle was attached, by which it closed its valves. It is this muscle in our Natives which gives such trouble to the inexperienced opener of oysters.

Mollusca or shell-fish lived in large numbers, and some of them were of very high organisation. Among these were the *Nautilus Ammonites* and *Belemnite*, all belonging to the class of *Cephalopoda*, or Mollusca whose organs of locomotion are situated round the head. The first two of these had

chambered cells, and may often be found in the pits at Nutfield. The *Nautilus* ought to be regarded by us with the greatest veneration, for it is one of those rare instances of a genus which had its beginning very far back in time, and has successfully competed for existence with contemporaries of all descriptions; and after living through all the changes of geography and climate which our globe has undergone, and seeing race after race of beings come into existence, continue for a time, and become extinct, has survived them all, and now flourishes in the seas of the present day. Its days, however, appear now to be numbered; the genus has dwindled to three or four species, *Nautilus pompilius* being perhaps the best known.

The Ammonite was not unlike a *Nautilus*, but stood rather higher in the scale, the most obvious difference between the two being that the edges of the chambers in the Ammonite are crenulated—that is, they fitted into one another by a most elaborate notched arrangement, very like that seen in the bones of the human skull. These joints or sections in the *Nautilus* were plain. The siphuncle, too, or shelly tube which connects the interior of the chambers together, runs inside the back of the Ammonite shell, while in the *Nautilus* it runs through the centre of the shell.

The Belemnite belonged to another order of cephalopods. Its shell was of a different kind to that of the *Nautilus*. The greater part of it was thin and easily broken up, and the only relic we find in the Lower Greensand is that portion known as the guard or rostrum, which, being of hard, solid carbonate of lime, has escaped the destruction which overtook the rest of the animal. But, from specimens found in the clay of an earlier formation than the one we are treating of, we know that it was covered with this thin shell, and the presence of an ink-bag showed that it bore considerable resemblance to the *Sepia* Cuttlefish of our present seas.

In our neighbourhood the Lower Greensand consists of four members: the lowest, the Atherfield Clay, on which is the Hythe division, which forms the tops of the hills; then the Sandgate Beds, to which it is probable the Fuller's-earth

belongs; and the Folkestone Sands, which are of much cleaner character than the other divisions. We see them here in Mr. Pym's pit, and various small sections; and I think its being cleaner and generally of smaller grain may show that it was formed at a greater distance out to sea than the Sandgate and Hythe Beds, which contain pebbles and a large mixture of clays and earthy limestones from material most probably brought down by the river. In some of these clear yellow sands, on the spot where the Oxted Station on the new Croydon and East Grinstead Line is situated, and which, I believe, belong to the Folkestone division, I noticed last spring many pieces of drift-wood interspersed throughout the section some six feet or so deep, as if the current which bore them thither had continued to flow for some time, long enough to allow of sand to accumulate for about six feet. This wood had been decayed all except the outer part, which was converted into a crust of oxide of iron. In some cases the interior appeared to have been replaced by a brown fibrous mass of the same material.

Now we have travelled over the ridge of hills, and descend into Holmesdale, at the bottom of which we come upon a bed, the Gault, which exhibits very great differences in several respects to those we have considered. First, its mineral character differs, as it consists of a dark blue or slate-coloured clay. Next, the assemblage of fossil remains is found to have altered. But the crowning distinction of all consists in its showing that a break in time has taken place between the last deposited layer of the Lower Greensand and the existence of the clay-bottomed sea in which the Gault was formed. And in this another principle of Geology is well displayed—that is, Upheaval and Denudation. Where we get a section showing where the Gault lies on the Folkestone Sands we see that there is no merging of the one into the other, as was the case between the Wealden and the Lower Greensand, but the top beds of the sand have been worn away. Now this could not have taken place at the sea-bottom, as there there could have been no agency capable of effecting such a wearing away of the sandy beds; so we come to the conclusion that

they must have been slowly raised above the sea-level, and formed dry land. Such land would come under the influence of rain, snow, frost, and streams, and all the meteorological agencies which tend to carve the solid land of the globe into the rugged condition of hill and dale which we see; and as the land sank again the sea would finish the degrading action of the rain and rivers by cutting through it horizontally, cliff by cliff, and so giving the surface a final levelling.

Such was the surface on which the Gault Clay of the new sea was to be deposited; but of the intermediate land surface we of course should know nothing; it had been all swept away by the sea. A junction of beds of this character, where the upper is lying on a worn surface of the lower one, is what is known as an *unconformity*—the beds are unconformable to one another (or, as a student of Dr. Duncan's used expressively to say, they are "*uncomfortable strata*").

This break in time is further shown by the very few fossils which are common to the Gault and Lower Greensand. In fact, with the Gault we enter upon a new era—that of the Cretaceous or Chalk Period; for although the Lower Greensand used to be considered as a part of the cretaceous system, its differences quite entitle it to be regarded as a separate formation. It is now known as the Neocomian, a name given to it from the locality in Switzerland where it attains its largest development, Neufchatel or Neocomium.

Though one of the minor members of the Cretaceous system, the Gault attains in our district a thickness of over three hundred feet, and from its mineral character we may infer that when it began to accumulate a great difference had taken place in Physical Geography. The nature of its fauna indicates a quiet sea, rather shallow, as the cephalopods with which it abounds are kinds found at no great depth. Taken altogether, it may be said to be rich in fossils, though it is curiously uncertain in this respect. I have not been able to obtain a great variety of forms from this district, though in the Lower Gault at Folkestone fossils are plentiful enough. It is true that there we get the Gault beautifully exposed in the cliffs, and about here good sections are scarce. I asked a

workman employed in a brick-works at Westerham, near Limpsfield, to save all the fossils he came across, and some weeks after I went there and found he had done as requested; for he produced about half a pint of fossils, but unfortunately, with one or two exceptions, they were all Belemnites of the small species *minimus*. These little Cuttlefish must have swarmed in the Gault sea, for in some places they seem to be the commonest fossil. At Limpsfield I have obtained a small Crab, *Palæocorystes Stokesii*, and with this were fragments of Ammonites, with the common *Inoceramus concentricus*, and a few doubtful shells. The period occupied in the formation of the Gault must have been very prolonged, judging from the difference in the fossil forms of its different layers.

It is a characteristic of clay beds, wherever they occur, that they form the flatter parts of the land's surface, and to this rule our Gault is no exception, for as we proceed northward across the marshy clay bottom of Holmesdale we find on coming to an elevation that the nature of the rock has changed—that we have reached the Upper Greensand which overlies the Gault. It appears that after the Gault Clay was deposited a small upheaval occurred, giving rise to shallow water conditions and the prevalence of strong currents.

Several things seem to indicate this. First, the Upper Greensand occurs only in a limited region; it is not widely spread; it is wanting at Folkestone, for instance, where the Gault comes immediately under the Lower Chalk; and if we go to Norfolk and Lincolnshire we find none there, though it occurs again in the North of Ireland. At Cambridge, which we may regard as intermediate between our district and the counties I have mentioned, we find unmistakable traces of the Gault having suffered denudation, though not very largely, and possibly no great extent of it was raised above the sea. These evidences are the prevalence in the Cambridge Greensand of fossils proper to the Gault, which have been worn by rolling as on a beach, and with these are the bones of sea-birds; though this Greensand of Cambridge is not considered as the exact equivalent of our more southern

Upper Greensand, for geologists believe that it was accumulated at a somewhat later date; but this does not matter. All that I want to show is that a slight upheaval of the seabottom took place at the close of the Gault deposition. But whatever small uprising of land may have happened then, we have ample evidence that soon after—that is, soon, speaking in a geological sense—a great and widespread depression took place, for the ocean in which the Chalk was formed was undoubtedly a deeper one than any we have yet considered.

We are all of us pretty familiar with chalk. It is the most striking formation of the south and east of England, and I need hardly remind you of its connection with the name “Albion.” Its thickness at its greatest development is about 1000 feet. The most remarkable fact concerning it, and which at the same time shows what an immense period must have elapsed during its formation, is, that by far the larger proportion of it is composed of the dead shells of the minute *Foraminifera*, so small that “hundreds of them would hardly weigh a grain.” It is separated into two divisions, the Upper Chalk, with flints; and the Lower, which occurs in our district, without flints. This Lower Chalk has a large admixture of clay, and much of it consists of the fragments of the bivalve shell *Inoceramus*, which were secreted from a very brittle variety of carbonate of lime, the mineral Aragonite. This brittleness is the reason why we so seldom find a good specimen of the shell.

Chalk is actually being formed at the present day in certain parts of the Atlantic, at depths between 6000 and 14,000 feet, where a substance is dredged up from the bottom formed almost entirely of these Foram. shells, of the kind known as *Globigerina*; and as we do not find any great accumulation of these shells in depths much less than 6000 feet, we infer by analogy that the chalk ocean was of considerable depth likewise.

It was found during the voyage of the ‘Challenger’ that on this chalky bottom various animals flourished; among them Crustacea, Echini or Sea Urchins, and several Mollusca and

sponges, just as they did at the bottom of the cretaceous ocean. Among the chalk bivalve shells we find one class very commonly, the Brachiopods. These differ very considerably from the ordinary double-shelled Mollusca, and by some naturalists are made into a separate group. The most striking difference is, that, while in the ordinary Lamelli-branch shells, such as Cockles and Oysters, the animal wears its shells one on each side, the Brachiopods wear their shells in front and behind, and may be compared with the walking advertisements who bear two boards in the London streets.

The number and variety of Sea Urchins which lived in the Chalk Period is very noticeable, and, as different genera are found to characterise certain horizons in the chalk, we are enabled by their means to classify the upper division into zones. I have here a small specimen of *Ananchytes oratus*, from the Middle Chalk of Caterham Junction, which has been taken possession of after the death of the animal and loss of its spines by several forms of life, *Ostrea*, *Crania*, *Bryozoa*, and *Serpula*. I spoke of the broken *Inoceramus* shells as forming a large portion of the Lower Chalk. It is by means of their different species that this lower division is classified into zones.

One of the most interesting problems is that afforded by the Flint, and perhaps by the light of expeditions like that of the 'Challenger' we may obtain an inkling of its solution. In the interesting paper read at our last meeting, Mr. Lovett made an observation on the occurrence of sponges parasitic on living marine animals, and alluded to some possible bearing it might have on the phenomenon of fossils embedded in flint. There is one division of sponges, the *Clionidæ*, which bore into the shells of molluscs, and it is believed that they accomplish this by means of their skeletons which are entirely made up of siliceous spicules. The *Clionidæ* occur fossil in very old formations, but little is as yet known about them. At all events, many things seem to point to the probability that sponges had something to do with the formation of flint, which has undoubtedly at some time or other been

in a soluble state and has been again re-solidified. Sometimes on breaking open a flint nodule we find the cast of the sponge itself in flint. I have a small specimen here which looks like a minute petrified bath-sponge, the sarcode of which seems to have been replaced by flint, and this, I believe, is an example of the state in which the sponges are usually found. We do not know what the black colour of flint is due to; it has been ascribed to iron, manganese, and even organic matter. That the flint was formed during the continuance of the Cretaceous epoch, and is not always a subsequent production, is certain, because we find in Belgium evidence that some of the chalk was upraised and abraded off, the flint nodules it contained being worn into pebbles, and mixed with these pebbles are unworn fossils of the chalk.

The genera of cephalopods I have already described; the Nautilus, Ammonite, and Belemnite lived in the chalk ocean, but the decreasing proportion in which they stand to other molluscs is noticeable. The Ammonites, which attained their maximum number in a prior formation, the Lias, are now dying out, and in connection with this impending extinction a very remarkable thing is to be noted. In no other formation do we get such an extraordinary variation in the forms of Ammonites as in the Cretaceous. It seems just as if Nature said to herself—"These Ammonites seem to be getting crowded out by other animals; let me see if I cannot modify their form so that they shall be able to hold their own." So she altered their shells into all sorts of strange shapes, but it was of no use; they died out and became extinct before the next epoch, the Tertiary, fairly commenced. I have figured these various forms; they have received different generic names, but they are essentially Ammonite shells. The same fate befel the Belemnite, for we do not find that in any formation subsequent to the Chalk.

I remarked, in treating of the Wealden, that a great change in the vegetable life of this region shortly took place, and this is one of the reasons why we regard the Neocomian as a formation distinct from the Cretaceous; for we find that up to the top beds of the former all the forms of vegetation were

quite of a Jurassic type, or that of the epoch prior to the Wealden; but with the Gault the flora is that characteristic of the Tertiary Epoch, which follows the Chalk; in fact it is the type of the present day, for we *are* living in the Tertiary. In the chalk of Aix-la-Chapelle and the Pyrenees, leaves of the oak, beech, fig and elm, and the fruit and leaves of the walnut tree have been found, and also relics of the *Proteaceæ*, now represented in Australia and at the Cape. It is only natural to suppose that the types of terrestrial life would be less permanent than marine life, for the oceans are always connected with one another; while great stretches of land may become isolated, or, as I have endeavoured to show, may disappear altogether beneath the sea.

With the Chalk the reign of Reptiles came to an end. These had been the dominant form of the Mesozoic or Epoch of the Middle phase of life to which our Chalk belongs, and we see the last representatives of a group of truculent marine reptiles in the *Mosasaurus*, whose skull in a rather fragmentary state I have represented. I have brought a vertebral joint of this reptile, which was found in the Upper Greensand of Betchworth.

Another reptile belonging to a different class also died out, the *Pterodactyl*. A phrenologist is hardly needed to read its disposition from its skull; and when we take into account that it could walk, swim, and fly by means of a bat-like patagium extended by its enormously-developed little finger, and that one has been found in the chalk of Maidstone which measured sixteen feet from tip to tip of its wings, I think we may congratulate ourselves that we are so far removed from it in time.

Now a word with regard to the reptile-like bird. This has been named the *Hesperornis*, and its remains were found in the Cretaceous as represented in America. It was an aquatic bird, well fitted for diving. Its wings were merely rudiments. It displays some points of structure characteristic of the Emeu. Its head was long and narrow, and the shape of its brain decidedly reptilian. But the most astonishing feature was its teeth, true teeth, not mere notches in the horny

covering of the beak, but bony teeth growing from grooves in the jaws, and these are essentially reptilian. It is worthy of remark that it had none in the premaxillæ; and in the bird-like reptile, the Iguanodon, there was likewise an absence of teeth in those bones; though this coincidence is of no importance whatever, as it can only be regarded as a trivial character.

I have mentioned several Cretaceous genera which are not found in the Tertiary Epoch which followed, and one might think that a sudden catastrophe had overtaken these forms of life; as although we see the lowest Tertiary beds lying directly on the chalk, we find no trace of them in any part of the Tertiaries, and to the earlier geologists it appeared as if in the new strata an entirely fresh type of beings had suddenly come into existence. But we now know that there is no such thing as a universal break in the stratified deposits. If in any particular region of the globe a period of time is not represented by the formation of a stratified deposit, that period must have been occupied in denuding strata already formed there; but deposits must have been forming somewhere else, and it is in these intermediate beds that we find intermediate forms of life; and although such a marked hiatus seems to come between our Cretaceous and Tertiary formations, recent researches have shown that during that period, represented only by denudation here, a series of beds were being laid down in America in which we can trace the gradual merging of the Fauna of the one into the Fauna of the other.

And now we have ascended the chalk hills and look northward towards the overlying Tertiaries of the London Basin, but at these I will stop. In this paper I have endeavoured to illustrate a few of the leading principles of Geology by means of the local strata, and I should feel gratified if, in the course of it, I had given to those unacquainted with the subject some particulars of interest.

A discussion followed, in which Dr. Bossey stated that Dr. Cooke reckoned it would take ten days of twelve hours each, at the rate of sixty a minute, to count the Forams. in one ounce of chalk.

RULES.

NAME.

I.—The Association shall be styled "THE HOLMESDALE NATURAL HISTORY CLUB."

OBJECTS.

II.—The investigation of the Natural History of Reigate and its vicinity, and the mutual improvement of the members in the study of Nature.

CONSTITUTION.

III.—The Club shall consist of Members, Subscribers, Corresponding Members, and Honorary Members.

MEMBERS.

IV.—Members shall be elected by ballot or show of hands at any Ordinary Meeting. The candidate to be recommended by one or more Members at any Ordinary Meeting, and the election to take place at the Meeting next ensuing.

SUBSCRIBERS.

V.—Subscribers shall be elected in the same manner as Members, and shall have all the privileges of Members, except of holding any office in the Club, or of voting upon any matter connected therewith, or of having any right or ownership in the property of the Club.

CORRESPONDING MEMBERS.

VI.—It shall be competent for the Club to elect as Corresponding Members any gentlemen distinguished for their attainments in Natural History, either as collectors or authors, or to whom the Club may be indebted for contributions of papers or specimens; such Corresponding Members to have similar privileges to Subscribers without payment, and to be elected by the Club upon the nomination of the Committee.

HONORARY MEMBERS.

VII.—Honorary Members shall be elected by the Club upon the nomination of the Committee; and shall be exempted from the payment of subscriptions, and shall have the privileges of Subscribers.

OFFICERS.

VIII.—The Club shall, at the Annual General Meeting, elect from among themselves a President, Treasurer, Secretary, Curator, and nine Members to form a Committee of Management, three of whom to form a quorum.

VICE-PRESIDENTS.

IX.—The President shall nominate annually two Vice-Presidents from the members of the Committee.

ANNUAL GENERAL MEETING.

X.—This shall be held previous to the Evening Meeting on the third Friday in October, when the Committee shall present a Report detailing the general state, proceedings, and pecuniary condition of the Club, and proceed to the election of officers.

SPECIAL MEETINGS.

XI.—The Committee shall have the power to call a Special General Meeting at any time; and they shall do so within four weeks after receiving requisition to that effect, signed by at least five members. The notice calling the Meeting shall state the objects for which the Meeting is called, and no other business shall be transacted.

ORDINARY MEETINGS.

XII.—These shall be held on the third Friday in every month, from October to April inclusive, or more frequently at the option of the Committee.

SUBSCRIPTIONS.

XIII.—Each Member shall pay to the Treasurer Ten Shillings on his election, and the same sum at the Annual General Meeting each year; but may compound for such Annual Subscription by payment of Five Pounds. Each Subscriber shall pay to the Treasurer Five Shillings on his election, and the same sum at the Annual General Meeting each year. That it shall be optional with the Committee to strike out the name of any Member or Subscriber who shall be in arrear with his Subscription for twelve months or more.

NEW RULES.

XIV.—Any five Members wishing to propose a New Rule, or the omission or alteration of any existing Rule, must send notice to the Secretary, who shall within a month call a Special General Meeting to consider the change proposed.

LIBRARY AND COLLECTIONS.

XV.—The Club shall form, as opportunity may offer, a Library of Reference, consisting of works bearing on the subject of Natural History; and obtain Collections of the natural objects of the neighbourhood. The Library, Collections, and Funds to be the property of the Members for the time being, and shall be vested in Trustees for the use of the Members. Contributions of Life Members shall also be invested in the names of such Trustees in such manner as the Committee may direct, the interest arising therefrom to be handed to the Treasurer for the general purposes of the Club.

ELECTION OF TRUSTEES.

XVI.—The Trustees shall consist of the President for the time being, and three other Members to be elected by the Club.

LIST OF MEMBERS AND SUBSCRIBERS.

*Names marked * are Honorary Members.*

Names marked † are Corresponding Members.

- ASHBY, EDWIN; Adelaide, S. Australia.
ASPLAND, THEOPHILUS L.; Rosenheim, Reigate.
ASPLAND, Mrs. T. L.; do.
BAXTER, ROBERT C.; Hethersett, Reigate.
BEEBY, W. H.; 14, Ridinghouse Street, London, W.
BENNETT, ARTHUR; High Street, Croydon.
BOSSEY, FRANCIS, M.D.; Mayfield, Redhill.
BRASS, Rev. HENRY, M.A.; Redhill.
BURT, MAJOR; Reigate Road, Redhill.
BUTTON, BENJAMIN; Richmond.
CAREY, FREDERICK GEORGE; Southbank, Redhill.
CAZENOVE, Rev. Canon, M.A.; St. Mark's Vicarage, Reigate.
CHEAL, JOSEPH; Lowfield Nurseries, Crawley.
COOPER, THOMAS; Brighton Road, Redhill.
CROSFIELD, JAMES B.; The Dingle, Reigate.
CROSFIELD, HERBERT; do.
CROSFIELD, Miss; do.
CROSFIELD, ALBERT J.; Carr End, Redhill.
CROSFIELD, Mrs. A. J.; do.
CUDWORTH, JAMES I.; Woodcote, Reigate.
CUDWORTH, Mrs. J. I.; do.
DUNCAN, WILLIAM A.; Woodlands Road, Redhill.
*EVELYN, W. J.; Wotton House, Dorking.
FERNELEY, CHARLES A.; High Street, Reigate.
FIELD, J. LOUIS; Brooklands, Redhill.
FLEMING, VALENTINE A.; Holbrook, Redhill.
GABELL, ALVERSTONE, L.D.S.; Station Road, Redhill.
GILBERT, HORACE W.; De Tillens, Limpsfield.
GILFORD, WILLIAM; Beech Grove, Redhill.
GILL, JOSEPH JOHN; Rossmead, Redhill.
GILL, Mrs. J. J., do.
GODWIN-AUSTEN, Lieut.-Col. H. H., F.R.S., &c.; Deepdale, Reigate.
HEATON, WILLIAM H.; Meadowcroft, Reigate.

- HOLMAN, CONSTANTINE, M.D., J.P.; The Barons, Reigate.
 HOLMAN, MRS. C.; do.
 HORNE, EDWARD, J.P.; Park House, Reigate.
 KENSIT, E. E.; Holmesdale House, Reigate.
 LAINSON, HENRY, J.P.; Colley Manor, Reigate.
 LEES, JOHN; Reigate.
 LINNELL, JOHN; Redstone Wood, Redhill.
 LUBBOCK, Sir JOHN, Bt., M.P.; 15. Lombard Street, London, E.C.
 MARRIAGE, THOMAS SYDNEY; Bell Street, Reigate.
 MENZIES, Rev. JAMES; Redhill.
 MITCHELL, JOHN M.; 2, Trinity Road, Upper Tooting, S.E.
 MORELAND, Miss; Torfield, Reigate.
 NEWMAN, THOMAS P.; Springfield, Reigate.
 NEWMAN, MRS. T. P.; do.
 NICHOLSON, JAMES; Salmon's Cross, Reigate.
 NOAKES, RICHARD; Bridge Road, Redhill.
 PAINE, W. DUNKLEY; Cockshot Hill, Reigate.
 PAWLE, FREDERICK; Northcote, Reigate.
 POWELL, F.; Hill Bank, Redhill.
 †POWER, J. A., M.D.; 65, Ashburnham Road, Bedford.
 ROSLING, HENRY; Alders Road, Reigate.
 SEXTON, WILLIAM W.; Cambridge Villa, Redhill.
 SILLITOE, F. S.; Station Road, Redhill.
 STERRY, ARTHUR C.; Heatherlea, Redhill.
 STERRY, JOHN; Earlswood Road, Redhill.
 STERRY, MRS. J.; do.
 STONE, GEORGE G.; Eastcote, Redhill.
 TINDALL, ERNEST E. P.; Ranelagh Road, Redhill.
 TYNDALL, WILLIAM H.; Morlands, Redhill.
 TYNDALL, MRS. W. H.; do.
 VAUGHAN, HOWARD; 55, Lincoln's Inn Fields, London, W.C.
 WALDUCK, CHARLES E.; South Leigh Cottage, Dorking.
 WALTERS, JOHN, M.B., J.P., Church Street, Reigate.
 WATNEY, DANIEL; 62, Old Broad Street, London, E.C.
 WEBB, HENRY; Redstone Manor, Redhill.
 WEBB, SYDNEY; Luther Terrace, Folkestone Road, Dover.
 WEBB, WILFRID M. K.; 31, Aynhoe Road, West Kensington Park,
 London, W.
 WHITE, WILLIAM B., B.A.; Grammar School, Reigate.

23 DEC 1884



23 JUN 1887

PROCEEDINGS
OF THE
HOLMESDALE NATURAL HISTORY CLUB
FOR THE YEARS 1884 AND 1885,
TOGETHER WITH
RULES, AND LIST OF MEMBERS.

LONDON:
PRINTED BY WEST, NEWMAN & Co., 54, HATTON GARDEN, E.C.

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1886.

Honorary Secretary:

ALBERT J. CROSFIELD, *Carr End, Reigate.*

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PROCEEDINGS
OF THE
HOLMESDALE NATURAL HISTORY CLUB.

EVENING MEETING.—JANUARY 11TH, 1884.

Mr. Arthur Bennett, of Croydon, exhibited specimens of the following Recent Additions to the British Flora:—

Ranunculus ophioglossifolius, Vill.—Found by Mr. Groves at Hythe, near Southampton, in 1881.

Ononis repens, L., var. *horrida*, Lange. — For some years I have known that the *Ononis* of the Norfolk and Suffolk sand-hills was not described or recognised in our present Floras; and on sending specimens to Prof. Lange, of Copenhagen, he replied:—"Your specimens are exactly what I do mean by *O. repens*, var. *horrida*."

Selinum Carvifolia, L.—Discovered in Lincolnshire by the Rev. Mr. Fowler; in Cambridgeshire by Mr. Cross, of Ely. In September last I had the pleasure of accompanying Mr. Cross and Mr. Fryer, of Chatteris, to the station for it in Cambridgeshire. It occurs in profusion on the slightly-raised banks that extend round and run into the Fens.

Erythræa sphaerocephala, Towns.; *E. capitata*, W.—Found by Mr. Townsend in the Isle of Wight, on the Downs near Freshwater. The original plant of Willdenow was found near Berlin, but it has never been re-discovered by the Berlin botanists; and the Isle of Wight, Sussex, and Scandinavia are the only places in the world where it is now known. It differs from all other species of this genus by the stamens being inserted at the base of the corolla.

Potamogeton lanceolatus, Smith.—Gathered in 1804 by the Rev. H. Davies, in the River Lligny, in Anglesea. Since

Davies gathered it, Mr. Borrer, Mr. Webb, Mr. A. G. More, Prof. Babington, and Mr. C. Bailey have collected it. In 1880 I found it in Burwell Fen, Cambridgeshire, and since then it has been sent me amongst unnamed specimens by Mr. Orr, of Dublin, gathered in Co. Down. It is perhaps the most interesting species in the British flora, seeming to be a strictly endemic species, as it has not been known anywhere else in the world. It has only been known to fruit once, and then only two fruits were perfected, in my garden, from the Cambridge specimens. From this fact it is probable it may be a remnant of an older flora, when Britain enjoyed a warmer climate than at present; at least this is suggested by Dr. Nyman, of Stockholm.

Potamogeton Zizii, Roth. — Found in Cauldshiels Loch, Roxburgh, by Mr. Brotherston, of Kelso; afterwards sent me by Mr. Bailey from the English Lakes, and this summer by Mr. Fryer from Cambridge and Hunts; and only last September Mr. Beeby discovered it in Hedge Court Mill-pond, in S.E. Surrey. It is not a common plant in Europe, but extends to N. America.

Potamogeton Griffithii, Ar. Bennett. — Found in Lly-an-afon, near Aber, Carnarvon, at 1250 ft. elevation. Mr. Griffiths sent me a series of specimens from this lake, and after comparing them with all known species I was unable to refer it to any. I named it after its discoverer, who had worked most energetically at the N. Wales flora. I am glad to say that my friend Dr. Tiselius, of Stockholm, and the Rev. Mr. Morony, of the United States, concur in thinking it a new species, their opinion being valuable as they have been students of the genus for many years. It is difficult to believe in a plant being confined to a single Welsh lake, and the result of isolation should be well considered; but it cannot be referred to any described species.

Najas graminea, Del., var. *Delilei*, Magnus. — In a mill-pond near Ashton, Lancashire, in water kept tepid by the condensation of steam by a mill. It is a native of tropical and subtropical countries, and has probably been introduced with cotton from Egypt.

Naias marina, L.—This I had the pleasure of finding in Hickling Broad, E. Norfolk, the largest of the East Anglian meres, covering as it does between four and five hundred acres. In Europe it occurs in all the countries opposite to our eastern shores, and eastwards to Lithuania. It is found in America, Australia, and the Island of Bourbon, and Africa.

Carex ornithopoda, Willd.—Found in Miller's Dale, Derbyshire, by Mr. Whitehead.

Carex frigida, All. — Found by Mr. Sadler in the corrie of Loch Ceander, above Glen Callater, in Aberdeenshire. An interesting species, being one of the few that occur in the Scottish Highlands that do not occur in Scandinavia. In Europe it occurs in the Central European mountains.

Carex ligerica, Gay.—St. Mary's, Scilly Isles, Cornwall.

Chara connivens, A. Br. — A specimen was found in Mr. Borrer's herbarium at Kew by the Messrs. Groves, localised for Stokes Bay, Hants. Since gathered at Slapton Sands by Mr. Waterfall, of Bristol.

Chara baltica, Bruzel.—Found by Mr. Curnow, of Penzance, and passed by as a variety of *hispida*, until careful examination showed it to be Fries' species. A native of N. Europe principally.

Lychnothamnus stelliger, A. Br.—Found by myself in Filby Broad, E. Norfolk, in 1880; and in 1881, in Heigham Sound, Hickling, in the same county; and this year by Messrs. Hanbury and Holmes in West Somerton Broad. It is local on the Continent, and not known out of Europe. The female plant is very rare, but I found it in 1881.

Chara fragifera, Dur. — Discovered by Mr. Ralfs, of Penzance, near the Land's End, Cornwall, and figured and described as a British plant by Dr. Trimen in the 'Journal of Botany.' It is rare in Europe, being nearly confined to the west and south of France, and occurs sparingly in N. Africa.

Chara contraria, Kuetz. — Found by Mr. H. Groves in Wicken Fen, Cambridgeshire; and the same month by myself in Heigham Sounds, E. Norfolk. A very variable species, and widely distributed in Europe, Africa, and America.

Chara Braunii, Gmel. — From the Canal at Reddish,

Lancashire. Gathered last August by Mr. Whitehead, but as *C. fetida*; and again by Mr. C. Bailey in September, who kindly sent me a specimen. I saw at once it was a species new to Britain, and it was so announced at the Southport Meeting of the British Association. A well-marked species and generally distributed on the Continent, and extending to Africa and America.

Carex trinervis, Degland. — Found by Mr. Glaspoole on sand-hills in Norfolk.

This list comprises nineteen species, of which thirteen are aquatic plants, showing that our rivers, canals, and lakes are far from exhausted.

Of other extremely local plants, *Najas flexilis*, R., known up till 1880 from Ireland only, has been found in several E. Perth lochs by Mr. Sturrock.

Liparis Loeselii, the rare Fen Orchis, I have seen from Suffolk, Norfolk, and Cambridge this year.

Senecio palustris, DC., another fen rarity, I have seen in Norfolk this year, and know of at least three stations in that county and one in Suffolk where it still occurs.

Lobelia urens, L., long known from Devonshire, has been gathered by Mr. Briggs in E. Cornwall; but a lady was really the discoverer some two or three years ago.

Senecio spathulifolius, DC.—Long known under the name of *Cineraria campestris* var., from Anglesea, until Mr. Griffiths sent Prof. Babington seeds and fresh specimens, who determined it to be the above, and figured and described it in the 'Journal of Botany.' Mr. Backhouse, of York, has found what seems to be the same plant in N. Yorkshire. A Western and Central European species.

Dr. Bossey exhibited under the microscope the protoplasmic movement in *Nitella opaca*.

Mr. E. Lovett presented his paper on 'Preparing Embryological Organisms'; and Mr. John Linnell presented a copy of 'Physiography,' by Prof. Huxley.

Mr. W. H. Tyndall read the following 'Meteorological Notes for 1888':—

The barometer has not shown any great fluctuations during

the year. During a strong gale from the south on September 1st and 2nd it fell to 28·88 in. for a short time, the only time noted on which it fell below 29 in. On 176 days the barometer stood at 30 in. and upwards; on 188 days it stood between 30 in. and 29 in.; and on 1 day it fell below 29 in.

The thermometer has not exhibited great extremes of heat or cold. The minimum was on March 15th, when it fell to 15°. The maximum was on June 16th, July 15th, and August 16th, when it reached 80°. There were 102 days on which the thermometer fell to 32° and under; 45 on which it reached 70° and over; 3 on which it reached 80°. In 112 years only six years have occurred in which the average temperature of the year has been less, *viz.*:—1785, 1786, 1789, 1814, 1837, and 1845.

Rain. — The total fall is very little above the average. February and November were the wettest months, next July. March and August were nearly equal, and December the driest. The greatest number of wet days were in January and November; the least in April and May. No great falls of rain occurred, the heaviest being on September 10th and 11th, when 1·14 in. fell; and on November 25th, when ·96 in. fell. The longest period of consecutive days of rain was 14 days, from March 17th to 30th; strictly speaking it was snow, and there was little of it, 1·09 in. on the whole. Again, from June 18th to 29th, 12 days, 1·76 in.; from September 23rd to October 5th, 13 days, 2·03 in.; and from November 17th to 27th, 11 days, 2·76 in. The total fall of the year was 29·81 in. on 196 days. Very little snow fell during the year; $\frac{3}{4}$ in. fell on December 6th. The greatest periods without rain were March 31st to April 13th, 14 days; May 27th to June 14th, 19 days. Only six periods of 6 days together without rain occurred.

Wind.—Strong gales occurred on January 27th, February 10th, March 6th and 22nd, and on November 17th and 25th.

On March 30th the S.S. 'Aquillæ,' from Weymouth to the Channel Islands, encountered heavy waves at midnight in still weather. They passed away again about 1 o'clock.

On Sept. 19th there was a remarkable halo round the sun about 5.30, and prismatic colouring round the moon at 10 p.m.

Sun-rises and sun-sets of unusual grandeur occurred. On November 25th to 29th (sun-sets), December 4th and 5th (sun-rises), and December 23rd (sun-set).

These glows have been attributed to the presence of volcanic dust in the atmosphere.

Fog prevailed from December 24th to 29th; it was not very dense.

The reading of these notes was followed by a discussion, in which Lieut.-Col. H. H. Godwin-Austen, F.R.S., referred to the rainfall at Cherrapoonjee, in Assam, where the mountains rise suddenly to an elevation of 4000 ft. from marshes scarcely raised above the sea-level. The mean rainfall of five years measured 495 in., and fell between May and November, 31 inches once falling in one day. The consequence is that the soil is washed away down to horizontal strata of hard sandstone rock. The finest waterfalls in the world, 2000 ft. in height, leap from the rocks into the fertile valleys. The drainage is very rapid. It is considered to be the greatest rainfall in the world. Forty miles further inland the rainfall is only about 150 in. in a year.

Mr. Carey remarked on the green colour of the moon at the time of the recent brilliant sunsets.

Dr. Bossey spoke of the effect of gases projected with enormous force to very great heights, mingling with spherical particles of water causing prismatic action. He attributes the mildness of the present winter to the unusual quantity of vaporous particles in the atmosphere.

Mr. T. P. Newman attributed the rosy sunsets seen in London to the dust in the air, which acts as globules of moisture do. He stated that snow has fallen in Spain containing volcanic dust similar to that of Mount Cracata, in Java. Mr. Newman said that last year's rainfall measured by him at Reigate was 31.90 in. He considers the Reigate Hills accountable for the quantity at Reigate being greater than at Redhill.

Mr. Gilbert exhibited a Camberwell Beauty Butterfly, caught by him on Copthorne Common on August 24th, 1872.

EVENING MEETING.—FEBRUARY 15TH, 1884.

Mr. Henry Tuke Mennell, F.L.S., of Croydon, exhibited a large collection of Land and Fresh-water Shells, and read a paper, entitled 'A Plea for Collecting Shells.'

The relations of this study with Geology are very intimate. All the great families of Mollusca existed as now in earliest geological times, though recent species of shells are found fossil only in the most recent strata. In the Coralline Crag, out of 340 fossil species, 73 are now living as British and some others are now living in more southern seas. The Common Whelk abounds in recent geological strata, but it is a curious fact that the fossil whelks are turned the opposite way from the recent shells. The prevalence of certain families and groups at various geological periods varies greatly, yet all the great groups are present in the earliest organic rocks. This is a most important and interesting fact in its relation to development.

CEPHALOPODA, including Cuttles, Nautilus, Ammonites, &c. --190 species are now living, against 1500 fossil species.

PULMONIFERA. Land Snails, &c. — 4300 species are now living, against 460 fossil species. But we must bear in mind that the fossil marine record is far more perfect than the fossil land record.

BRACHIOPODA. Bivalves with unequal parts. — 75 living species, against 1300 fossil, of which half were British.

CONCHIFERA. Bivalves.— 3100 living species, against 5600 fossil.

It is remarkable that the Cephalopods, though the highest group, are yet the most abundant fossils. Development is more evident in the succession of families within the great groups than in the groups themselves; *e.g.*, in Cephalopoda, the lower-organised families, the Belemnites attain their highest development and grow scarce just as the higher Cuttlefishes appear on the world's stage. Many whole families or groups have been lost. Against 100 fossil species of Nautilus, but 4 are recent; against 500 to 600 fossil species of Ammonites, none remain.

The BRACHIOPODA were most widely distributed in geological

time, both in depth and in climatic range, and it is the same now.

CONCHIFERA become more and more numerous as time advances, and relatively are more abundant now.

The questions of geographical distribution present equally interesting problems. Take, for example, the genus *Helix*, which ranges from the northern limit of trees to Terra del Fuego. 1200 species are described, taking the world over; only 50 fossil extinct forms are known. Geographical distribution confirms the theory of evolution, which the geological record appears rather to contradict. Interest attaches to immature forms; fixed Conchifera (as Oysters) have the young free; and naked molluscs when young are protected by a shell.

The MOLLUSCA attain the highest degree of perfection in their own type; their digestive and reproductive arrangements are very perfect. As far as we know, these animals and representatives of all its divisions existed and were as highly developed throughout all geological time.

Passing to our special subject, we are only concerned with two families:—

GASTEROPODA (stomach-footed).—Aquatic, 32; terrestrial, 74; total, 106 British.

CONCHIFERA (bivalves).—All aquatic; total, 15 British species; making a total of 121 species of land and fresh-water shells. Of these, 113 are common to Europe north of the meridian of Bordeaux, and 115 are common to Europe south of the meridian of Bordeaux. 80 of these species are fossil or subfossil in the Upper Tertiaries, commencing after the Coralline Crag, and including Alluvial Deposits.

Turning to our local *County* Fauna we find—

13 out of 15 Aquatic Conchifera.

26 „ 32 „ Gasteropods.

7 „ 10 Slugs.

28 „ 33 Helices and allies.

17 „ 31 Bulimi and Pupæ.

91 121 Total.

The chief desiderata being in the genera *Vertigo* and *Pupa*, there is clearly scope for further investigation.

EVENING MEETING, TO WHICH YOUNG PERSONS WERE SPECIALLY INVITED.—APRIL 4TH, 1884.

A pair of Koodoo horns, from S. Africa, were presented by Mr. J. Louis Field, to whom the thanks of the Club were given.

Mr. Thomas Cooper described "The Wild Animals of South Africa."

Baboons are not ferocious, but attack only in self-defence. Once when bathing, Mr. Cooper heard the cry, "Wha," and was shortly surrounded by a troop of Baboons, which did not molest him. On another occasion he saw over seventy together, many old Baboons carrying young ones in their arms.

The Leopard is popularly known as the Tiger in S. Africa.

The Flat Hog or Wart Hog is not a true Pig, having no teeth. It lives on the open plains.

The Lion is far from being a courageous beast. It may be driven from its prey by a bushman enveloped in tambookigrass. The natives consider it safe to hit a sleeping Lion with a stick in the day-time, so driving it away. If the native retires from a sleeping Lion, it will follow his scent when night comes on. Mr. Cooper told of many stirring adventures with Lions.

Mr. Cooper exhibited the skull of a very low-type Bechuana. Many of the Caffirs are fine men, of great intellectual power. They are well acquainted with all the plants of their districts, and with their properties.

Mr. W. H. Tyndall read some notes on 'The Elm Tree.' He remarked that Elms are found over the whole of England; over Europe, N. Africa, Western Asia, and various species in America. They prefer a rich loam, but will grow anywhere with depth of soil. They attain at times a height of 80 to 90 ft., and a diameter of 4 to 5 ft. The bark has been used in dyeing and in sugar-refining, and in Norway has been mixed with meal for bread. The fruit-seeds rarely ripen in England; they are eaten by pigeons and poultry. The roots spread superficially, and throw out suckers from which the young trees spring up. The timber is hard, open-grained,

and red; it is not used for cabinet-work, but for keels of ships, foundations of bridges, coffins, and formerly for water-pipes. At the age of about 150 years Elms begin to decay.

EVENING MEETING.—APRIL 25TH, 1884.

Mr. A. J. Crosfield exhibited a fungus (*Morchella crassipes*) gathered on the banks of the Esk, in Yorkshire, by Mr. Philip Sewell. Lieut.-Col. H. H. Godwin-Austen, F.R.S., &c., stated that a similar species of Morell grows in the Deodar-forests in Kashmir, and is largely used by the natives for food. It is also eaten in France.

Mr. Thos. Cooper exhibited some Oak-wood, from the Fullers'-earth pits, stained a light green colour. Dr. Bossey explained that the colour was due to a fungus. The stained wood is used in Tunbridge Wells-ware. Dr. Halifax grew the fungus from the spores thus obtained, breaking the Oak into the consistency of sawdust, and placing it on damp blotting-paper under a bell-glass.

The President mentioned that Mr. H. W. Gilbert felt the late shock of earthquake (on April 22nd) at Limpsfield.

Lieut.-Col. H. H. Godwin-Austen, F.R.S., F.R.G.S., F.Z.S., then described "The Great Moraine at Ivrea":—

Ivrea lies about thirty miles to the north-west of Turin, and opposite the great valley of the Dora Baltea, which flows down from the Mont Blanc range. The East Lateral Moraine, known as La Serra, is fifteen miles in length; the West Lateral Moraine, which is more broken, extends seventeen miles, and the arc to the south is twenty-six miles round. La Serra rises to a height of 1500 ft. above the present level of the plain.

There is clear evidence, from the markings on the rocks, that the Val Dora was formerly filled by a glacier up to a height of 2000 ft. above the present valley. The Susa Valley was also then filled with ice, which came down to the hills around Turin. Similar enormous glaciers are now at work in the Pir Punjaub Range, in Kashmir, bearing along enormous blocks of granite.

The reason why the East Lateral Moraine of Ivrea surpasses the West Lateral in height is seen by reference to the map. Many more feeders fall into the Val Baltea from the east than from the west. Detritus carried onto the eastern side of the glacier would finally be discharged on the east, on the plains. The material of Alpine Moraines is more angular than Himalayan detritus, owing to the enormous length of Himalayan glaciers, some extending thirty miles, so that the detritus is rendered subangular in its long journey. In the Rhone Valley blocks may be found similar to the Himalayan.

Glaciers are always either advancing or retreating. The Alpine glaciers are now retreating very rapidly; many of the Himalayan are advancing. The Moraine at Ivrea proves periodic advances and retreats of the glacier. When the ice began to retreat the Moraine was thrown to the sides; then came an advance again, and fresh hills of detritus were added. The Eastern Lateral Moraine is four miles across, and shows the lines marking retreat and advance of the glacier. The Western Moraine is not so perfect; the River Chusella has cut right through it. On the east we find a lower inner Moraine, which was cast up when the glacier was finally retreating. Very beautiful sections may be seen near Arona.

Opposite every valley the tendency is for a "Fan" to be cast up; this is caused by the soil brought down by the rivers gradually raising their bed and banks above the level of the surrounding country; then, in time of flood, a fresh channel is formed, and the same process is repeated.

Some rounded hills are not Moraines, but are bosses of diorite, over which the ice has travelled, as the stria-marks upon them prove. We have also near Ivrea clear proof that ice can excavate hollows out of harder rock on a small scale, leaving beautiful little lakes. Larger lakes, such as Como and Maggiore, do not owe their origin to ice-excavation, but are to be accounted for by yet older configuration of the surface; mountain-tarns are often formed by ice-action. That a large lake extended in recent times almost up to Ivrea is proved by beds of clay containing fresh-water shells. The largest lake left, the Lago d'Ivroni, has no outlet; the Dora

Baltea formerly flowed through it, and the bed of the river can be traced below the lake. On the east the sea formerly swept up, and the Moraine bears evidence in parts of deposit under water. In the Valley of the Chusella we meet with beds of clay and sand full of marine shells, 1059 ft. above the present sea-level, resting on diorite rock; these beds are protected by a steep scarp of diorite.

Ice-action may be traced in Surrey, where we find masses of flint resting on gault and greensand, where they have been deposited by glaciers. The South Downs were covered with a coating of ice; the drainage was then reversed, the rivers flowing from north to south, and on melting of the snows flint masses were borne southward on the floating ice. In Thibet there are now similar beds of frozen snow, 40 or 50 ft. thick.

Discussion followed, in which Mr. Tyndall, Mr. Linnell, and Mr. Gill took part.

ANNUAL MEETING.—OCTOBER 17TH, 1884.

The Annual Report and Balance Sheet were read as follows:—

HOLMESDALE NATURAL HISTORY CLUB.

Annual Report, October 17th, 1884.

During the past twelve months six new members have been elected into the Club; ten have left the Club by resignation; and we have to record the death of two of our members, Sir Sidney S. Saunders, President of the Club from 1874 to 1876, and Mr. C. Marshall, who served on the Committee. The total membership in the Club is now seventy-six.

Sir Sidney Smith Saunders, K.C.M.G., died at his residence, Upper Norwood, on April 15th, 1884, aged seventy-four years. His name will long be remembered in scientific circles, more especially on account of his study of Hymenoptera and their parasites, and of the parasites of Coleoptera; and our Club is deeply indebted to him for the careful arrangement of our collection of Hymenoptera, as well as for valuable papers

contributed from time to time. Sir S. S. Saunders entered the Consular Department of the Foreign Office in 1826, and was appointed Consul to Albania in 1835; he was transferred to Alexandria in 1859, and was Consul-General in the Ionian Islands from 1864 to 1870.

The following papers were read or addresses given at the evening meetings during the winter months:—

Oct. 12, 1883. 'The Orchids of Surrey,' by Mr. W. H. Summers, of Dorking.

Nov. 9. 'The Habits of the Stalk-eyed Crustacea of the British Isles,' by Mr. Edward Lovett, of Croydon.

Dec. 14. 'Notes on a Recent Visit to the Isle of Portland,' by the President.

Dec. 14. 'Remarks on the Marine Life of the Reigate District,' by Mr. H. W. Gilbert.

Jan. 11, 1884. 'Recent Additions to the British Flora,' by Mr. Arthur Bennett.

Jan. 11. 'Meteorological Notes for 1883,' by the President.

Feb. 15. 'A Plea for Collecting Shells,' by Mr. H. T. Mennell, F.L.S., of Croydon.

April 4. 'The Wild Animals of South Africa,' by Mr. T. Cooper.

April 4. 'The Elm Tree,' by the President.

April 25. 'The Great Moraine at Ivrea,' by Lieut-Col. H. H. Godwin-Austen, F.R.S., F.Z.S.

Five whole day and five afternoon excursions were made as under:—

Whole day.

- April 19. Penshurst and Ide Hill.
- May 17. Gomshall and Chilworth.
- June 21. Haslemere and Frensham Ponds.
- July 19. Warlingham and Brasted.
- Sept. 20. West Hoathly and Ashdown Forest.

Afternoon.

- May 3. Headley Heath.
- June 7. Norbury Park.
- July 5. Penshurst Place.
- Aug. 9. Addington Hills.
- Oct. 4. Godstone and Tilburstow Hill.

At Frensham, *Carex arenaria*, L., and *Scirpus setaceus*, L., were found; and Dr. Bossey obtained one of the confervoid Algæ, *Rivularia echinata*, in Frensham Great Pond.

On the occasion of the excursion from Warlingham to Brasted, Dr. Bossey obtained a *Chara* at Chelsham, which Mr. N. E. Brown, of Kew, has identified as a singular form of *C. fetida*, A. Braun, approaching the variety *gymnophylla*, some of the young stems and branchlets being quite destitute of cortical cells.

On the hills about two miles to the east of West Hoathly, *Gentiana Pneumonanthe*, L., was found growing on peaty ground; and *Salix repens*, L., grew profusely on the peaty moorland. In a bog forming one of the sources of the Newhaven Ouse the following species were abundant:—*Narthecium ossifragum*, *Drosera rotundifolia*, *Potamogeton polygonifolium*, *Wahlenbergia hederacea*, *Anagallis tenella*, and *Scutellaria minor*.

At the Evening Meetings the following exhibits were made:—

Dr. Bossey exhibited under the microscope specimens of *Nitella flexilis*, Agardh, found at Hindhead.

Mr. N. E. Brown, of Kew, exhibited a living specimen of *Chara Braunii*, Gmel.

Mr. Arthur Bennett exhibited specimens of the following rare plants:—*Ranunculus ophioglossifolius*; *Ononis repens* var. *horrida*, Lange; *Selinum Carvifolia*, L.; *Erythraea capitata*, Willd., var. *sphærocephala*, Towns.; *Potamogeton lanceolatus*, Smith; *P. Zizii*, Roth.; *P. Griffithii*, Ar. Bennett; *Naias graminea*, Delile, var. *Delilei*, Magnus; *N. marina*, L.; *Carex ornithopoda*; *C. frigida*, All.; *C. ligerica*, Gay; *C. trinervis*, Deg.; *Chara connivens*, A. Br.; *C. baltica*, Bruzel; *Lychnothamnus stelliger*, A. Br.; *Chara fragifera*, Dur.; *C. contraria*, Kuetz.; *C. Braunii*, Gmel.; *Liparis Loeselii*, Rich.; *Senecio palustris*, DC.; *Lobelia urens*, L.; *Senecio spathulifolius*, DC.

Mr. H. T. Mennell exhibited a fine collection of land and fresh-water shells.

The following presentations have been made to the Club:—A pamphlet on '*Naias marina* as a British Plant,' by Mr. Ar.

Bennett. A series of Fossils, by Mr. W. Allingham. A pamphlet on the 'Preparation of Embryological Organisms,' by Mr. E. Lovett. Prof. Huxley's 'Physiography,' given by Mr. J. Linnell. A pair of Koodoo horns, by Mr. J. Louis Field.

ABSTRACT OF ACCOUNTS.

<i>Receipts.</i>			<i>Expenses.</i>		
	£	s. d.		£	s. d.
Oct. 1883.			1883 & 1884.		
Balance	32	11 3	Rent of Museum to		
1884.			June, 1884	15	18 5
Subscriptions.....	25	11 6	Cleaning, &c.....	1	2 0
Hire of Museum	2	10 0	Printing	3	6 8
Flora of Surrey	3	2 11	Collector's Commission		
			and Stamps (6/6) ..	1	8 0
			Balance in hand	42	0 7
	£63	15 8		£63	15 8

Examined and found correct, { T. P. NEWMAN.
October 17th, 1884. { J. B. CROSFIELD. } *Auditors.*

The following gentlemen were elected as Officers for the ensuing year:—*President*, Mr. W. H. Tyndall; *Treasurer*, Mr. R. C. Baxter; *Curator*, Mr. J. Linnell; *Secretary*, Mr. A. J. Crosfield; *Committee*, Dr. Bossey, Messrs. T. L. Aspland, T. Cooper, J. B. Crosfield, H. W. Gilbert, J. J. Gill, Lieut.-Col. H. H. Godwin-Austen, Messrs. T. P. Newman and Rd. Noakes.

It was decided that the meetings of the Club be held on the third Friday in each of the winter months, instead of on the second.

A Record Book of the Macro-Lepidoptera occurring in the neighbourhood was presented to the Club on behalf of Mr. Edwin Ashby, by whom it was compiled. It was stated that Mr. Sydney Webb had checked the records. The thanks of the Club were given to Mr. E. Ashby.

Mr. A. J. Crosfield exhibited dried specimens of *Leersia oryzoides*, collected at Brockham in August; and *Polygonum maculatum* (Dyer), from Earlswood Common (August, 1884).

Mr. J. Linnell remarked that in 1858 he had gathered *Leersia oryzoides* with much larger panicles than those exhibited. He attributed this to the unusual sunshine of 1858.

Mr. A. C. Sterry exhibited a small fish which he had found living inside a jelly-fish in the Channel Islands.

Dr. Bossey exhibited under the microscope the Alga from Frensham, *Rivularia echinata*, in appearance like a ball surrounded by tapering threads. He stated that this species is not found on the Continent of Europe.

Mr. N. E. Brown, of Kew, then described "The Development of Starch Granules":—

The nucleus of the cell develops around it bodies known as leucoplastids, and on, and apparently by, these leucoplastids a new growth is formed, which is the rudiment of the starch granule. He supposed that the successive layers of which starch granules are composed, as indicated by the annular markings upon them, were produced by the using up of the starch formed in the chlorophyll granules each day under the influence of daylight, and that, as the leucoplastids secreted starch during the night as well as by day, when the supply from the chlorophyll granules each day began to fail, the starch secreted by the leucoplastids would become more watery, thus accounting for the separation into layers of the starch-granules. In some cases the leucoplastid remains attached to a fully-developed starch granule.

Mr. Brown also explained "Continuity of Protoplasm":—He thought that in some cases it originated with the division of the nucleus itself. He stated that the nucleus of the cell is the denser portion of it, and from it every other part is formed; in it resides the potentiality of growth. In time the nucleus divides, numerous protoplasmic threads connecting the two separated parts of the nucleus. Shortly afterwards the whole cell is divided into two by a wall of cellulose; but probably the threads which connected the two nuclei remain continuous through the new wall, and keep up a connection from cell to cell throughout the plant, this process being repeated *ad infinitum*.

Mr. H. M. Wallis, of Reading, gave the following—

NOTES ON ITALIAN SWITZERLAND.

Amongst the Birds of Italian Switzerland many differ slightly from the English forms. The Sparrows, for instance, have the same note, habits, flight and general appearance as our House Sparrows, only the crown of the head is of a

uniform chocolate-colour, and this species is known as the Italian House Sparrow. You may often see our English Tree Sparrow mixed up in the same flock with the Italian House Sparrows. Amongst the birds of prey the Black Kite abounds; this species is piscatorial in its habits, catching fish with its feet; it is very silent, though the same bird in Cairo is noisy. Wherever there are rocks Buzzards may be seen; they were breeding half-way down a most precipitous cliff; Mr. Wallis saw one carrying food, apparently a Lizard, to its young. At Porlezza he saw a Golden Eagle pursued by a Falcon. The Rock Thrush, though very shy, is not scarce; the male is a very handsome bird, with a slaty-grey head and back, a chestnut breast, and ruddy tail; the female is of a cinnamon-brown; in May the males were in full song, and sang continuously without a pause whilst on the wing. In the cliffs hundreds of Crag Martins or Cliff Swallows breed, placing their nests against the overhanging ledges of rock; in Porlezza they were picking up mud in the streets; they resemble Sand Martins, but are as large as House Martins; their note is harsh, and consists of three syllables run into one. Red-backed Shrikes, Nightingales, and Blackcaps are numerous. Amongst the tall reed-stems of Lake Varese he found nests of the Great Reed Warbler, a sombre, shy bird, about the size of a Sky Lark; its voice is harsh and resonant; eggs, which he exhibited, might be mistaken for Sparrows'.

Amongst the many exquisite plants growing on the rocky banks, pre-eminent for beauty is a Tiger Lily; its growth is stunted, the stem wiry, and heads of flowers large, so that it far surpasses in beauty the cultivated plants we are familiar with. Other striking plants are the White Asphodel and a Saxifrage (*Saxifraga Cotyledon*), bearing a spike of bloom a foot in length.

The Butterflies vary in a marked manner from those we are familiar with at home; the Small Heath, for instance, is a size larger than ours, and the Blues seem to form many intermediate links between one type and another.

Beetles are not abundant; their increase must be very much checked by Lizards. Rose Chaffers and Weevils seem the commonest kinds.

Helix pomatia runs into many varieties, from pale straw-colour to dark chestnut.

The advantage of the colouring of the Green Tree Frog is obvious to anyone who has seen one seated on the leafless bough of a Fig-tree. The resemblance of the Frog to a young green Fig must be a great protection from many enemies.

On an island in Lake Varese there was formerly a town on piles, and flint implements may be picked up. It may be noted that no flint occurs nearer than in Switzerland.

EVENING MEETING.—NOVEMBER 21st, 1884.

The President exhibited a curiously spiral stalk of *Asparagus* which grew this year in his garden at Redhill, and was an example of "fasciation" or blending of stems.

Dr. F. Bossey read a paper on 'Atmospheric Dust as related to Fermentation, Putrefaction, the Growth of Plants, and the Production and Spread of Infectious Diseases,' as follows:—

The atmosphere which surrounds our globe is loaded with dust. We see this dust dancing in the sunbeam of summer, and soiling the snow in winter. We inhale it with our breath; we swallow it with our food and drink. It is deposited on every surface exposed to the air, and it accumulates largely in all cracks, crevices, and unswept rooms.

Among other things, this dust contains the spores or seed-germs of many organised bodies. When cultivated artificially or allowed to grow spontaneously, many of these germs develop into minute unicellular plants or animalcules of the simplest form; but, if small in size and simple in structure, these organisms are by no means wanting in power or unimportant in their effects. In proof of this I need only mention that it is to some of them we owe the process of fermentation, by which we obtain our bread, as well as our beer, wine, and other alcoholic drinks; to others we are indebted for the production of putrefaction, by which the carcasses of dead animals are removed from the surface of the earth. Some, again, are the means of giving to the earth that fertility

by which plant-life is mainly sustained, while others are intimately concerned in the production and spread of infectious diseases.

I have in the first place to speak of Fermentation. This term is primarily used to express that process by which solutions of sugar, glucose, and maltine are converted into alcohol and carbonic acid; a change which is due to the presence and growth of a minute plant, the *Torula cerevisiæ* or Yeast Fungus. This plant consists of round or oval cells filled with protoplasm, having some small granules dispersed through it. These cells in growing produce an outgrowth or bud, filled with the same contents, growing to the same size, and budding in the same way as the mother-cell. These daughter-cells remain for a time attached to the parent-cell, and then separate from it. In this way the number of cells is very rapidly increased, this increase going on till the sugar is decomposed; while the plants which cause the fermentation become matted together, and, being buoyed up by bubbles of carbonic acid gas, float on the surface as yeast. Besides budding, yeast sometimes, but rarely, increases by the growth of spores; in this case the contents of the parent-cell become re-arranged, so as to produce one, or oftener two, or four, cells within the parent-cell.

That fermentation depends on the growth of this fungus is proved by its being present whenever that process is going on—by our being able to set up that process at will by introducing a small quantity of the living plant into a proper saccharine solution; and again, if we divide such a solution into two parts by a partition of filtering-paper, fermentation will go on in that part of the solution to which yeast has been added, and not in the other, although the liquid passes freely through the paper from one portion to the other.

I have now to proceed to the subject of Putrefaction. When the dead flesh of an animal is exposed to the air, it grows soft, moist, and emits an offensive smell. These are the obvious signs of putrefaction. If we take the smallest possible portion of the moisture from the surface of this putrefying flesh and place it under a microscope of sufficient power, we shall see in it thousands of particles, which reflect the light

rather strongly and have a dancing or Brownian movement, a movement which has been compared to that of a balance-wheel of a watch. These particles, when seen singly or on end, are round, but as they are commonly grouped in twos they present the form of a figure of 8. They are the *Bacterium Termo* of Cohn, and that they are the cause of putrefaction and associated with the dust of the air is abundantly proved in various ways.

Prof. Tyndall made an air-tight box with glass sides, and moistened its inner surface with glycerine. When this box was first made, a ray of electric light passed through it showed the air to be full of floating particles. After the box had been left for three days, these particles had fallen and become entangled in the glycerine. The electric light now showed the air to be pure or free from floating particles of dust. It was also found to be incapable of exciting putrefaction, for when tubes containing putrescible matter were introduced into it they underwent no such change.

In another experiment Prof. Tyndall prepared fifty flasks of putrescible but sterilised infusions. Twenty-five of these he opened in a hay-loft, and the other twenty-five on the edge of an Alpine cliff. The hay-loft series became full of organisms, and passed to a state of decomposition. The Alpine series, which had been opened in pure air, remained pure as before. Air may also be rendered incapable of producing putrefaction by passing it through red-hot tubes, by which the organic germs are destroyed; or by straining it through cotton-wool, by which they are filtered out; or by keeping up a freezing temperature (20°), at which they will not grow. Flesh and other putrescible substances may also be preserved by thoroughly drying them, or by placing them in or covering them by something which proves destructive to all germs.

Bacteria exist not only in the air, but also in the soil of the earth's surface, and as dust they pass from one to the other. In the soil they conduce much to its fertility, as they serve to reduce dead animal and vegetable substances to a condition in which they are available as nourishment for plants; this they do by breaking up the complex combinations of which

such substances are composed, and bringing them into the elementary or simple state required for the support of plant-life. Thus it is that some of the ammonia as well as nitrites and nitrates so useful to vegetation are from time to time supplied to the soil.

We come now to our last subject, the disease-producing Fungi. Formerly, when epidemic diseases were present, our forefathers said, "they were in the air"; and modern researches have not only proved the truth of this observation, but they have, in part at least, explained it, inasmuch as they have isolated and studied the life-history of some of the organisms on which several infectious diseases depend; and by this study they have shown that the germs by which they are propagated are exceedingly minute; that they are so tenacious of life that some of them are capable of inducing disease after being buried twelve years in the earth, while others retain their vitality after being exposed to the heat of boiling water or left in the air till thoroughly dried. Bodies so small and light may of course be easily transported from place to place as constituent parts of the everywhere-abounding air-dust, and carry disease with them.

The micro-organisms which are recognised as causing disease are arranged in four genera:—

1. *MICROCOCCI*, which consist of minute round or oval cells, multiplying by transverse and longitudinal division, and thence presenting themselves as single cells, chains, or smaller or larger groups. Smallpox, cowpox, erysipelas, &c., afford examples; and pneumonia.

2. *BACTERIA*.—Small oval or slightly elongated cells. Some species are very fatal to Poultry, Rabbits, and Mice.

3. *BACILLI*.—Rod-shaped cells, single or connected two together, and often angularly bent at the point of connection. Found in typhoid fever, glanders, scrofulous joints, consumption, anthrax, or splenic fever.

4. *SPIRILLA*.—Elongated cells spirally twisted, and often furnished with a flagellum or whip-like appendage at the end. Ague and relapsing fever afford examples of this, and Prof. Ray Lankester regards Dr. Koch's Comma Bacillus of cholera as a segment of a spirillum.

I think it would be out of place to enter into detail respecting each of these Fungi, and the diseases produced by them; I will therefore, in conclusion, mention only a few facts connected with their history, without any attempt at an orderly arrangement.

1st. They are minute in size. Mr. Nelson says:—"The average size of the *Bacillus* of tubercle is 1-9000th of an inch long by 1-60,000th of an inch broad, so that 32,400 would pack into a cubical box whose side was 1-1000th of an inch. The spores of many pass our finest filters, and elude the power of our best microscopes."

2ndly. Multiplication or increase.—It has been reckoned that by fission or division one individual can produce 8,388,408 in twenty-four hours. When the increase is by spores, it is more rapid.

3rdly. Cultivation and Attenuation.—I will give only the results of Pasteur's experiments on Anthrax. Grown on chicken-broth, this fungus produces spores in twenty-four hours, and afterwards becomes reduced wholly to germ-dust. If inoculated, this produces the disease, and causes death. But if grown at a lower temperature, 42° to 43° C., it produces threads only, and is entirely free from germs. In a month or six weeks the culture dies, and cannot be propagated in fresh broth. As the vitality of the microbe decreases its virulence diminishes, and this is proportioned to the time which has elapsed, that of the eighth day being less than the sixth, and the sixth less than the fourth; and each of these constitutes a vaccine, *i. e.*, a virus capable of producing a milder form of the disease. I may mention the result of an experiment on fifty sheep. Twenty-five were vaccinated with attenuated virus. A fortnight afterwards the fifty sheep were inoculated with the most virulent virus of anthrax. The twenty-five vaccinated sheep resisted the infection; the twenty-five unvaccinated died of splenic fever within fifty hours. The value of this discovery you will be able to estimate from the fact that in France alone splenic fever every year destroys animals of the value of 20,000,000 frs.

4thly. Germicides.—There are many other things in connection with my subject to which I might allude, but I will

only name one. Our investigation has shown several of our most fatal diseases to be the product of *living* organisms. We well know that for their existence all living organisms require certain conditions, and in the absence of these conditions they perish. We should therefore seek to find out what circumstances of climate, temperature, diet, or medication are inimical or fatal to the particular organism we are in danger of—say that of typhoid, consumption, or anthrax, for instance. We should also be careful, in our attempts to protect ourselves or others from these morbid agents, to guard against trusting to everything which goes by the name of disinfectant. Many of these are only deodorizers, and have no power to destroy the germs of disease. Indeed I think it would be well to discontinue the use of the word disinfectant, and to speak of deodorizers and germicides as two separate things, which they really are.

The most available and at the same time the most effectual germicide is heat, if properly applied; and should the return of cholera or any other serious epidemic render it necessary, there can be no difficulty in arranging gas appliances in such a way that the food and drink of every household may be effectually sterilised, that is, deprived of all the living disease-producing germs that may be in it.

The mention of this sterilising of our food induces me to add one word more on the analysis of our waters. Heretofore our analysts have confined their reports to the salts and gases in the water; but for sanitary purposes it is far more important to investigate by the microscope and by the process of culture the living germs present in the water. I understand this is now done at an institution in Berlin, and I trust it will not be long ere it is done in this country; and if it is, we shall soon learn to discriminate between those germs which are hurtful and those which are harmless, and this knowledge may lead to the prevention of many cases of sickness and death.

In reply to Mr. A. C. Sterry, Dr. Bossey said that diseases may be divided into three classes:—(1) Those that exhaust themselves after a time; (2) those that become more virulent after each attack; (3) intermediate.

The vigour of the growth of fungi, as of other plants, depends on the seed and on the soil. We know that the growth of some plants exhausts the soil; other plants grow anywhere and for any length of time. So with disease-germs. Smallpox, for example, grows for a limited time till the nourishment is exhausted, whereas the typhoid germ can always find its needed nourishment; the consumption microbe finds nourishment in some persons, and not in others.

In reply to Mr. Gill, Dr. Bossey stated that organisms have been found in cases of hay-fever, but he was not aware that they were known in common catarrh.

Mr. Newman remarked that scavengers were usually strong, hearty men, and therefore not good soil for typhoid germs.

Dr. Bossey expressed the opinion that water carries infection far oftener than the air does.

Mr. James Backhouse, jun., of York, described the "Physical Geography, Flora, and Fauna of Iceland."

Iceland contains good natural harbours on the north, east, and west coasts. On the eastern coast the mountains rise steeply from the sea to 3000 ft., and the fiords are narrow and hard to navigate. The rocks and soil are entirely volcanic. The geysers and hot springs are well-known features; some of the springs are hot enough to boil food in a few minutes; one lava-bed is forty-five miles in length by thirty miles broad. Towards the east of Iceland is the high glacier-covered tableland, the Vatna Jokul, 3000 square miles in area! Watts crossed it with a guide in 1875, at great risk of his life. The Lagarfljot Lake is forty-five miles in length, reaching to within half a mile of the sea, into which it empties itself by waterfalls. The most recent volcano is Askja, 3000 ft. in height, which was in eruption in 1874; volcanic dust consisting of powdered pumice fell to a depth of four inches over the adjacent valleys; it was then raised by the wind, and gradually subsided into heaps; Hecla has not been active for many years. The highest mountain in Iceland, Orefa Jokul, is about 6400 ft. Several of the largest rivers rise in the Vatna Jokul, Lagarfljot being one of the longest.

There are only two woods in Iceland, the trees being Birches; in one of these, at Hallormstade, where the trees

reach the height of twenty feet, Messrs. Backhouse and Clarke met with the Rock Ptarmigan (*Lagopus rupestris*), a species almost entirely confined to Iceland and Greenland. They obtained a fine series of skins during the month of September, 1884, and established the fact that this bird passes through no intermediate stage of grey between the summer and winter plumage. Most of the migrants had left Iceland before September, those met with being the Wheatear, White Wagtail, and Golden Plover.

Mr. Backhouse obtained skins of the Long-tailed Duck, Wigeon, Teal, and Mallard; he did not meet with Barrow's Goldeneye, known only as European from Iceland. The Great Auk formerly bred on a rock to the west of Iceland, on which it is now almost impossible to land. Mr. Backhouse was informed that forty years ago six Great Auks were brought into Reikavik in a sack, which occurrence probably ranks amongst the latest records of this now probably extinct bird.

At Thorshaven, in the Faroe Islands, Oystercatchers were in large flocks on the moors. Rock Pipits were abundant, and the Northern Wren (*Troglodytes borealis*) was obtained. The climate of the Faroes is most dismal; the Gulf Stream divides and surrounds the islands, and during three-quarters of the year the islands are enveloped in mist. The plants blossoming on the Faroes in September were *Armeria maritima*, *Lychnis flos-cuculi*, *Erica tetralix*, and *Calluna vulgaris*.

Amongst plants noticed in Iceland was a Gentian similar to *G. campestris*, but more branching; *Gentiana nivalis* was met with sparingly. The most abundant species were *Dryas octopetala* (on the leaves of which the Rock Ptarmigan live during the winter), *Silene acaulis*, and *Empetrum nigrum*; *Saxifraga Hirculus* was plentiful. The chief exports of Iceland are sheep, horses, eider-down, shark's-liver oil, sulphur, and fish (chiefly Cod).

Mr. Backhouse exhibited skins of most of the birds named above.

EVENING MEETING.—DECEMBER 19TH, 1884.

Mr. T. Cooper exhibited a fasciated growth of *Asparagus*. It was suggested that the abundance of such growths noticed this year might be connected with the heat or dryness of the season. Mr. T. Cooper also exhibited a specimen of *Imperata arundinacea*, a South African grass of great beauty.

Mr. Edward Lovett, of Croydon, gave "Natural History Notes on Jersey."

Speaking first of the Geology of Jersey, he said that almost all the rocks are igneous, there being very few primary rocks, clay slates only coming to the coast in one spot. Eastward of the harbour of St. Helier stands a huge mass of very hard, pink syenite, on which the fort is built; it is evidently part of an old intrusive vein; the surrounding rocks being coarse diorite of large hornblende crystals, very liable to decompose. At the south-eastern corner of Jersey the shore shelves very gradually, and is strewn with broken rocks; at low water, during spring tides, a stretch of six miles in length is uncovered, and affords a splendid hunting ground. On the east coast volcanic lava occurs, the natural flow of which is generally preserved; but this form merges into the spherulitic one. In the north of Jersey occurs an aplite or bi-granite, composed of felspar and quartz, which is worked for stone-ware. On the north coast there is no shore, and navigation is always dangerous, owing to breakers and strong currents.

Mr. Lovett described a cave he had explored, which is 100 ft. above the sea-level, and appears to have been used as a workshop by prehistoric man—probably at the time when both Jersey and England were part of the Continent of Europe, and when an alluvial plain took the place now occupied by the British Channel. The floor of the cave consisted of decomposed felspar, below which was cave-earth containing many flakes of worked flints. A large block of sandstone was also in the floor of the cave. Neither sandstone nor flint occurs *in situ* in Jersey. The cave was most likely formed through the decomposition of a soft vein of syenite, setting loose a block which was rolled about by the waves, and would fully account for the cave being hollowed out.

St. Owen's Bay, in the west of Jersey, consists of blown sand, and bears evidence of more than one change of level. Sea-sand covers peat-beds which seem to extend under the sea, and, under the peat, sea-sand may also be traced; this seems to prove that the coast was once sea-covered, that the sea retreated and again encroached. Corbiere Point, to the south-west of Jersey, is very dangerous, from scattered rocks; the syenite is of very bright pink felspar, and very white quartz. Several valleys run inland, from the south coast; they are probably due to local glaciation. Flints which occur on the sea-shore in some parts of Jersey are probably due to ballast having been cast there, a large export trade in oysters having formerly been carried on, the boats for which came in ballast.

Amongst insects, the Jersey Tiger Moth is of interest, though not a British species. The large shell, *Mastra glauca*, though till recently so rare as not to be known in its live state as British, was found in abundance on one part of the coast by Mr. Lovett. *Haliotis tuberculata* is found on some of the outlying rocks, though now very scarce in Jersey.

Mr. Lovett exhibited a Star-fish measuring more than a foot in diameter from tip to tip. Several Lizards are at home in Jersey, including *Lacerta viridis*, whose markings vary so much as to suggest the question whether there may not be more than one species; *Lacerta agilis* also is found; Adders are absent.

During the great snowstorm of January, 1881, a pair of Herring Gulls were driven on to a farm inland, and stayed there, bringing up their young in a nest on the ground at the foot of a hedgerow. The Golden Eagle and Great Bustard have been killed in Jersey, and Hoopoes frequently occur.

Ferns are very abundant in the banks of the lanes which intersect Jersey in all directions. *Scolopendrium vulgare* is quite a feature of the island. On the north coast *Osmunda regalis* grows profusely, and *Asplenium marinum* is luxuriant. *A. Adiantum-nigrum* is specially abundant in the east of the island, and *A. lanceolatum* in the west. The annual fern, *Gymnogramme leptophylla*, is now very scarce. *Asplenium ruta-muraria* grows in the walls of the fort, and *Ceterach officinarum* in St. Helier's.

Mr. A. C. Sterry mentioned the abundance of *Bugula avicularia* in Goubiot Cave, Sark, where the Bird's-head Polyzoa are also found.

Dr. Bossey mentioned that he had found forty species of Diatoms in a very little mud and sea-sand which Mr. Sterry brought from Jersey.

EVENING MEETING.—JANUARY 16TH, 1885.

Mr. Menzies exhibited some fresh-water Mussel-shells that appeared to have been nibbled by Rats.

Mr. H. M. Wallis exhibited the skin of a male Black Redstart, killed by him at Falmouth at Christmas. It had some small beetles in its crop. In its habits it resembles the Robin. Black Redstarts mostly visit our southern coasts in winter, being common in Germany, Switzerland, &c., all the year round.

Mr. Henry T. Mennell, F.L.S., of Croydon, described "The Physical Features and Flora of the Great North-West."

In the eastern part of Canada the rocks are mostly Laurentian, covered over large areas by Boulder-Clay, and Drift; and the general aspect of the country is uninviting. The mountains are the oldest on the American Continent, and are consequently not very high, their tops having been rounded off in the course of ages.

The botanical features of Eastern Canada, which consists chiefly of forest and swamp, and of land which has been cleared for agriculture, are not very interesting. The forest consists of small trees crowded together, but the number of species and families of trees is much greater than in Great Britain. In a short ramble forty or fifty species of trees may be counted, including Maples, Pines, Walnuts, Hickories, &c., both northern and southern types being mixed. The mixing of types may be traced to the action of the glacial period in driving northern species southward; being followed, on the melting of the glaciers, by an advance northward of the southern species. In Europe the advance northward of the southern types has been blocked by the Mediterranean.

From Lake Superior westward for 200 to 300 miles is a desolate region with a vast number of lakes, swamps, and pools, perhaps as many sheets of water as in all the world besides. The forest-trees become finer, and a purely American flora appears. This flora is characterised by a great number of Ericaceous shrubs, such as *Kalmias*, *Ledums*, *Andromedas*, and the great Cranberry, *Vaccinium macrocarpum*. Another prostrate shrub that abounds is *Chiogenes hispidula*, the Snow-berry. In the wetter parts *Saracenia purpurea* is found; it is a carnivorous plant with a pitcher-like leaf, the upper part of which is hairless and glabrous, the interior being covered with hairs that prevent the egress of insects that fall into it; its seeds are remarkable, with a large, flat, tabular, persistent style. Two plants abound that are very scarce in Great Britain, *Isnardia palustris* and *Juncus tenuis*.

The region of the Great Lakes is volcanic, and their drainage area very small, the watershed hugging Lake Superior. This gives rise to the question as to how the water system is fed, the outflow of the St. Lawrence being of great volume. It seems probable that the lakes must be fed by subterranean volcanic channels, and this theory is confirmed by the fact that the temperature of Lake Superior scarcely varies summer or winter from 40° Fahr.

To the west of the Swamp region the prairies begin to be watered by rivers flowing N. or N.E. Here are alluvial deposits with underlying Cretaceous rocks, the alluvial soil giving its immense richness to Manitoba. Though practically level for hundreds of miles, there are three steps in the Prairies, and three separate drainage systems of the Red River, and North and South Saskatchewan.

Between the main drainage districts are several small areas without any outlets, the streams losing themselves in lakes, which are consequently salt. The vegetation immediately surrounding the pools is destroyed by saline evaporations, and the district, from the aromatic character and silvery-grey foliage of the plants, is known as the "Sage Scrub." These plants are of many genera, but all have the same general character of foliage.

The Prairies are from 1000 to 1500 ft. above the sea-level.

They are covered with a very short growth of herbage, and have the appearance of worn-out pasture. In summer they are clothed with brilliant flowers, and in autumn with great numbers of *Compositæ*, including thirty or forty species of Asters of the Michaelmas Daisy type, *Rudbeckias*, *Gaillardias*, the smaller Sunflowers, *Solidagos*, and *Liatris*. *Petalostemon violaceus*, the Prairie Clover, is another species that abounds, and the species and families are mostly un-European. The look of poverty of soil is, however, deceptive. When the crust is turned over, a very rich black soil appears. Where a trench has been cut by the side of a railway, plants are found growing to a height of two or three feet, which on the prairie only grow to from three to six inches.

This rich black soil is of immense advantage to the settler. By ploughing early in the spring and getting in his grain at once, he secures an uneven crop the very first year. After cross-ploughing, during the second season he brings the ground into full cultivation. Farmers in Manitoba boast that they will be able to sell wheat in Liverpool at 20s. a quarter when they get the route by way of Hudson's Bay opened for summer traffic.

Between the Prairies and the Rocky Mountains lies a region of Cretaceous rocks, known as the Foot Hills; they are covered with rich pasture, and are not unlike our Downs; they rise abruptly from the plain. Owing to the dry air and small snow-fall, they are admirably adapted for cattle ranches, horses and cattle being able to keep themselves in condition through the winter. The line of junction between the Cretaceous rocks of the Foot Hills and the Cambrian of the Rocky Mountains is so abrupt as in some places to present the appearance of the Cambrian overlying the Cretaceous.

The North Pacific Railway rises to a height of 6000 ft. at Kicking Horse Pass, on the Rocky Mountains. Between the Prairies and the Pacific it has to pass through a mountain region 400 miles across, including three parallel chains. In one day Mr. Mennell recorded 190 species of plants near Kicking Horse Pass. The flora is closely similar to the European Alpine flora, forty per cent. of the species being identical with the European. *Silene acaulis*, *Dryas octopetala*,

and *Saxifraga oppositifolia* are in profusion. Other British plants noted were *Erigeron alpinus*, *Pyrola rotundifolia*, *P. minor* and *P. secunda*, *Potentilla fruticosa*, *Cystopteris montana*, the Holly and Parsley Ferns, *Poa minor* and *P. alpina*, *Oxytropis campestris*, two *Lycopodiums*, and *Smilacina bifolia*. The genus *Bryanthus* takes the place of our Heaths. It is probable that the connection of the Rocky Mountain plants with European has been by way of Asia.

The trees are fine, generally very lofty, but too crowded to be well developed laterally; Douglas Pines, Engelmann's Spruce, and Larches are prominent.

The effects of the North Pacific Railway upon the flora are already marked; all our most common weeds are following the course of the railway westward and appearing on cultivated ground, especially *Plantago major*, *Senecio vulgaris*, and *Capsella Bursa-pastoris*. Two or three western plants have appeared on the shores of Lake Superior, having been carried a thousand miles down the railway south-eastward.

Noticeable on the Prairies are the very numerous birds of prey, including Buzzards, Harriers, and Peregrines; they feed on small mammals, such as Ground Squirrels, Chipmunks, &c.

As the corn-line or isothermal is traced westward it runs far towards the north, the air being dry, and the days of summer long, with very great sun-power. The watershed between the rivers flowing into Hudson's Bay and those flowing into the Arctic Ocean is of very slight elevation; and it is to be remarked that the Mississippi and several of its branches, as well as several of the Hudson's Bay rivers, rise within a comparatively few miles of the Great Lakes.

The poverty and mixture of the flora of East Canada is accounted for, by Prof. Asa Gray, by the fact that the country was once covered with forest, the flora of which would be very meagre; when the ground was cleared, it was laid open for the introduction of plants (southern, northern, and aliens) from all sides.

Amongst characteristic plants of British North America generally may be named *Cornus Canadensis*, *Adiantum pedatum*, *Asters* (ninety species), *Solidagos*, *Enotheras*, and Maples, and Walnuts.

Mr. Mennell exhibited a fine series of specimens illustrating the Flora of the Great North-West.

EVENING MEETING.—FEBRUARY 20TH, 1885.

The company of young persons was specially invited, and about ninety of these were present.

Mr. H. W. Gilbert read a paper on 'How and Why Animals Differ,' from which the following are extracts:—

Living things are divided into two great kingdoms—the Animal Kingdom and the Vegetable Kingdom. It may seem strange, but it is by no means an easy matter to distinguish between animals and vegetables. If anyone asked us what was the difference between animals and vegetables, we might answer, as the most obvious distinction that occurred to us, "Oh! an animal can move, a vegetable cannot"; and this would not be a bad way of roughly distinguishing between the two kingdoms. But, strictly speaking, this definition would be of very little use to a naturalist, for I might mention several plants which can move, although they cannot move from place to place—for instance, the Sundew and the Sensitive Plant. But these we can see are plants by their ordinary characters, such as the possession of leaves and roots.

But here I have drawn a plant which is able to move from place to place. It is found in stagnant water and mud, and is named *Protococcus*. It is provided with a pair of little whips, called cilia, because they are like the hairs of eyelashes (Lat. *cilium*), and it is by the movement of these cilia to and fro that the *Protococcus* is lashed along. If you have a drop of water containing these little vegetables on the slip of the microscope, you can see them rushing in all directions at a great rate. The most wonderful thing is that we do not know what makes the cilia move, for they are certainly not put in motion by muscles, like the limbs of an animal.

But whatever differences may exist between animals and vegetables, there is one property common to both for a large portion of their lives, and that is the property of increasing

in size, and this is known as growth; and even when their full size has been attained, the waste caused by the wear and tear of living has—at any rate in the case of animals—to be made up for. This shows, then, that our principal object in life is to get something to eat. We can have no doubt that hunger is felt by every living thing, animal and vegetable alike, and now we come to the first of the landmarks from which I propose to start my sketch of the Differences of Animals.

In the process of eating, living things take in food. Plants take it in by their roots and leaves, and it increases their size under the influence of sunlight. But if animals simply took their food into their mouths and stood in the sunshine, they might wait a long time before they derived any benefit from it. So most animals are provided with a different piece of machinery, to digest their food, to that with which plants are furnished.

Of the five senses, we have three which are of great importance in enabling the animal to feed—seeing, smelling, and tasting.

But now I want to introduce to you an animal which finds its food without the aid of eyes, chooses it without the help of a nose, eats and digests it without any mouth, stomach or intestine, and moves about without being provided with limbs; and, as far as we can make out, it has neither nerves, brain, nor muscles of any kind. It is simply a tiny living body, and goes by the name of *Amaba*, or the Proteus animalcule; it looks like a very small particle of glue or jelly, and lives in stagnant water. Inside the *Amaba* we can distinguish a dark dot, which is called a nucleus; and sometimes a transparent spot appears, which keeps disappearing and forming again; we do not know what its object is, but it may act as a breathing-organ. When not at rest, if it wants to move along, it pushes out a blunt finger from some part of its body, and when this has reached a certain length the body itself crawls after the finger; if the finger touches something eatable, it wraps it up, so to speak, in its jelly, and the body then comes up and encloses both finger and eatable. When

the nourishment has been all extracted, the refuse, which is of no use, is pushed out of its body at any part, the hole so formed closing up, and leaving the body quite as whole as before.

Some of these animalcules make themselves houses, and these are of a very beautiful kind. Now suppose instead of each having a solitary house to itself, the *Amæba* found it would be an easier way of living and obtaining its food by clubbing together with a lot of other *Amæbas*, and getting them to join their houses to make a town of them. Such towns are in existence, and we call them Sponges. You know that a bath-sponge, for instance, is made up of a mass of fibres, and that through this mass holes, or we may call them streets, run in all directions; in certain parts of these streets, which we will call public squares, numbers of the small whips, or cilia, which I spoke of just now, are fastened to the walls, and these keep constantly lashing the water along; thus keeping up a constant current, and this current of course carries particles of food all through the streets.

Prof. Huxley describes the Sponge thus:—"It represents a kind of subaqueous city, where the people are arranged about the streets and roads in such a manner that each can easily appropriate his food from the water as it passes along."

Mr. Thomas P. Newman read a paper on 'Wind and Storm,' of which the following is the substance:—

Water always has a tendency to find its own level. Supposing it were possible to make a great hole in the surface of a sheet of water, the surrounding water would rush in and fill it up, and the rushing in to fill up the hollow would cause waves and motion over the surface generally. Air, being a gas, is even more easily moved than water, and so the slightest difference in level is met by an effort to regain it; and thus motion in the atmosphere is caused. The greater the difference, the greater the motion.

The atmosphere over the Atlantic is constantly flowing in big waves, like an immense river, from west to east, say from America to Europe, with areas of high pressure for crests, and depressions for hollows; and it is in this varying

weight of the atmosphere as it reaches our coasts that we have to look for the cause of wind and storm.

Before we go further, it is necessary to impress upon you a law which is of the utmost importance, and lies almost at the foundation of scientific weather-study; it is this:—"Stand with your back to the wind, and the barometer is higher on your right hand than on your left." This law was first formulated by a Dutchman named Buys Ballot, and so bears his name; it is so important that I recommend committing it to memory, and bearing it constantly in mind for all weather observations.*

We have learned that the atmosphere over the Atlantic is travelling towards us in a series of ridges and hollows of pressure; but these hollows are not nearly so often found in the form of the trough that we see between waves of water, as they are of a circular form—deepest, *i.e.*, having the lowest pressure at the centre, and gradually sloping up towards the outer edges.

These "depressions," as they are called, together with the phenomena which surround them, have been given the name of "cyclones" or "cyclonic disturbances"; not necessarily because they are storms, but merely from the Greek word, *κυκλος*, a circle; and when you hear a weather-man speak of a cyclone, or you see the word in the weather-news of the day, you may be assured that only one of these circular, low-pressure systems is meant, and that there is little fear of a great storm which you may have previously understood the word to mean. Now, round every one of these depressions the wind circulates in accordance with Buys Ballot's law. Stand so that the centre, where the barometer is lowest, is on your left, then the wind will be on your back, no matter whether you are N., S., E., or W. of the centre; and there is always a tendency to draw a little in towards the centre, and not to keep strictly parallel with the "isobars." We will come to the anti-cyclones presently.

The isobar is a line of equal barometric pressure, and is

* This law is reversed in the Southern Hemisphere, and does not apply to the equatorial regions of the Northern Hemisphere.

obtained by telegraphic reports of the height of the barometer from the various stations scattered over the kingdom and the coasts of France, Norway, &c., as shown on the map, at eight o'clock in the morning and six o'clock in the evening; some also report at two o'clock in the afternoon. The isobar is drawn in curves from one station to another where pressure is reported to be alike, and knowledge of the position of these isobaric lines lies at the very foundation of all that we know about the weather.

The track of cyclones is, in the large majority of cases, from S.W. to N.E., and happily the greater number pass to the W. and N. of our islands, often missing England; they affect the W. coast of Ireland, giving a real grievance to that unhappy country, and the N. of Scotland. In their front they are accompanied by high temperature and much moisture in the air, the sky becomes overcast, and there is a setting-in of mist and rain. As they pass away the rain ceases, the temperature rapidly falls, and the sky generally clears. At their approach from the S.W. the wind becomes S.E.; as they pass to the W. the wind veers to S., and when they have travelled to the N. the wind becomes W.; finally they pass away from our neighbourhood beyond Norway, and the wind is then N. and N.E. All the time you will see that, keeping the centre on our left, our back is to the wind, as it has gradually veered round with the progress of the storm.

Wind is said to "veer" when it changes with the sun, and to "back" when it changes against the sun; in this country it more often veers than backs, because the storms nearly all pass to the north of our island; and the wind veers when the depression passes to the north of us, and backs when it passes to the south.

All that we have said about the wind so far has been to explain its *direction*. We must now consider what is the cause of its varying *force*. After the explanations that have been given, this is comparatively simple. The hollows and ridges of the atmosphere, and the attempt made by it to regain a level, generate the motion or wind; and the deeper the hollows and the steeper their sides, the greater is the

effect and the stronger is the wind. When pressure varies greatly, that is, when barometer-readings are very different in two comparatively near places, the wind will be strong; and when pressure varies little, there will be little wind. In the weather-charts the arrows fly with the wind, thus indicating its direction; the barbs and feathers on them indicate its force; they are drawn more barbed and more feathered to denote stronger wind. Wind and storm, you will see, are only relative terms.

The term "gradient" is applied to the difference in height of the barometer at two places; gradients are always at right angles to the isobar, that is, they ascend from the centre of the depression to its outer edges. From the way in which the gradient is described, we gather the direction of the wind indicated. When we speak of a gradient from Valentia to Holyhead being for N.W. winds, we imply that the reading at Valentia is the higher of the two readings, the station with the higher reading always being placed first; and so a man standing midway between the two stations, with the lower barometer on his left-hand side, would face S.S.E. and have his back to the N.N.W.; the wind would therefore be N.N.W., which brings us back again to Buys Ballot's law.

We can now see its practical application: by observing the direction of the wind, even without any telegraphic information, we can tell the position in regard to ourselves of the cyclonic depression. We know that cyclones generally travel from S.W. to N.E., and we therefore can roughly foretell coming weather. When a S.E. wind is blowing, the depression, on our left as we back the wind, is in the S.W., and so is approaching us; it will probably bring warm weather, wind, and rain. With a northerly wind we shall have cold and fine weather, for the depression is somewhere to the east and has passed away from us.

Hitherto we have been considering low-pressure systems or cyclones; we now come to the opposite conditions, high-pressure systems or *anti-cyclones*. In these the isobaric lines are still very much in circles, but pressure at the centre, instead of being lowest, is now highest. The wind still

circulates round the centre, but it is very light in force, for gradients are easy, that is, pressure is nearly even over a large area; and it circulates *with* the watch-hands because the centre is the highest, and so is on our right hand as we turn our back to the wind; whereas in the cyclone it was on our left, and it has a tendency to draw *away* from the centre.

Anticyclones often extend over a very large area; they move very slowly, and so the conditions remain the same for a long period; and they are accompanied by dull, gloomy, misty weather. We can most of us remember the weather of Christmas, 1883; the sun was then obscured by mist for a whole fortnight; this occurred not only here, but from the Orkneys down to the north coast of Spain, and from Valentia on the west coast of Ireland to Denmark; and probably a great deal further in all directions.

The original disturbing action which produces motion in the atmosphere is the heat of the sun, but, as we have seen, the motions of the atmosphere are mainly regulated by the distribution of barometrical pressure over the globe, the particles moving from regions where the pressure is high to those where it is low.

A few words now as to the use of the barometer as a weather-glass; on old-fashioned barometers, and on a good many modern ones of an inferior class, will be found certain words, such as "Set Fair," "Fair," "Change," "Rain," &c., and as a consequence people are in the habit of saying when the weather does not accord with that indicated on the scale that the barometer "tells wrongly." Now the barometer only measures the weight of the atmosphere, and it is these words that tell wrongly; they are misleading, and ought to be entirely ignored. Neither the direction and force of the wind nor the rainfall depend on the actual barometer-reading at the time in any one place. I have known a storm with a S.W. wind that blew down a brick wall in my garden when the barometer stood above 30 in., or "Fair"; it constantly rains heavily with a N.E. wind and a very high barometer. Quite as often we have fine, clear, bright weather and a *low* barometer. As we have seen, it is the *relative* height of the

barometer at different places—that is, difference of level in atmospheric pressure—that affects the weather, not the actual height in any one place. It is by carefully comparing the weather-reports telegraphed to London from all the different stations that the Meteorological Officer is able to foretell the weather, and issue forecasts and storm-warnings; without these, however experienced, he would be utterly at a loss to do so. Our country is so situated that he cannot get nearly enough knowledge of coming disturbances for efficiently warning our own coasts, as we have seen storms approach us from the W., and we have no station farther W. than Valentia. Storms have occasionally approached so rapidly as to outstrip such periodical notice as can be given by our present system of telegraphic reports, much more to allow of warning being issued. We have, however, a system of reporting to Hamburg, and there have been few instances in which our office has not given them good notice of a coming storm.

Evening Meeting.—MARCH 20TH, 1885.

On the nomination of the Committee, Mr. Sydney Webb, of Dover, and Mr. N. E. Brown, of Kew, were elected as Honorary Members of the Club, in consideration of valuable services rendered to the Club.

The following extracts were read from a letter from the Rev. W. H. Summers, dated from Beaconsfield, February 27th, 1885. Referring to a list of localities at p. 40 in the printed 'Proceedings,' 1881-3, he says:—

"I am afraid the two new species are somewhat doubtful. One was a single plant, and Babington's *Rhinanthus major* seems to me almost to shade into the common species. The *Sedum* was said by one of the members, whom I afterwards showed it to, to be wrongly named.

"With regard to *Iris fetidissima*, on a late visit to its habitat I found, close by, a *Pæony* with double blossoms; hence I think that there is little doubt that it represents an ancient cultivation, though the spot looks wild enough now.

"*Iberis amara* occurs on the Juniper Hill Estate.

"This whole district (Beaconsfield) is very interesting. In some of the woods *Dentaria bulbifera* grows plentifully. I have also found *Scrophularia vernalis* and *Impatiens parviflora* (doubtfully wild).

"We have had lately great flights of the Brambling, numbering some thousands."

Dr. Bossey exhibited a specimen of the Hydra, and described its powers of reproduction of parts.

Mr. T. Cooper showed a Yellow-underwing Moth, caught in a greenhouse in January.

Mr. Arthur Bennett exhibited specimens of the following "Recent Additions to the British Flora," and read notes thereon:—

It may be thought somewhat surprising that I am enabled to speak of additions to the Flora of our country, as it is only last year I made some remarks on the same subject; but it may well be considered whether our Flora has been sufficiently studied with the aid of continental books and specimens, especially those of Scandinavia.

Last year I mentioned a Pondweed from Wales, *Potamogeton Griffithii*, and I am now able to show specimens.

The first addition to our plant-list is a Pond-weed, *Potamogeton fluitans*, Roth, gathered last year by Mr. A. Fryer, of Chatteris, Cambridgeshire, one of our keenest field botanists. This has many times been reported as British, only to be afterwards contradicted, a form of *polygonifolius* growing in deep water having usually been so named. Its continental distribution is quite in favour of its being British, as it occurs in Denmark, Germany, Holland, Belgium, and France. Mr. Fryer's specimens are satisfactory, except that no fruit has been gathered; but in all other points the specimens agree well with the true plant, of which I possess an extensive series, and have Mr. Fryer's and French specimens growing side by side.

Our next plant is rather a re-find, that is if it ever were found in Scotland, *Juncus tenuis*, Willd., gathered by Mr. Towndrow, of Malvern, at Cradley, Herefordshire. This was

figured in 'English Botany,' 1st ed., and thus noticed:—"Found by Mr. G. Don in 1795 or 1796 by the side of rivulets in marshy ground among the mountains of Angus-shire, but very rarely." No one has since found it in Forfar, and it has dropped out of our Floras as a mistake. It is widely distributed over the world from Europe and North America to New Zealand, where, however, my friend Mr. Cheeseman now thinks it may have been introduced.

Carex trinervis, Degland, found on the Norfolk coast in 1869 or 1870 by Mr. H. G. Glasspoole, amongst whose duplicates the specimens had remained until December, 1883, when, in looking over his Norfolk Plants, I found four specimens of this species. It is a Western European species, occurring on the coast sand-dunes in Denmark, Holland, the East and West Friesian Islands, Belgium, France, and sparingly in Portugal.

Carex acuta, Linn., var. *prolixa*, Fr. — Among Mr. Glasspoole's series of Norfolk plants I found a specimen of this gathered as long ago as 1844 by Mr. Priest, in marshes at Lakenham, Norfolk. These marshes are now drained and partly built over, I am informed by the Rev. E. F. Linton, of Sprowston, near Norwich. In this species the glumes are considerably longer than the fruit, and the fruit is more like that of *stricta*.

Carex acuta, L., var. *turfosa* Fr.—Two specimens gathered in Cambridgeshire by Mr. Fryer. Dr. Almquist writes, "Almost *turfosa*"; and to other specimens, also gathered by Mr. Fryer, he writes, "*C. acuta*, var. *gracilescens*, Almq." This was also sent me by Mr. Beckwith from Shropshire.

An interesting addition to the Irish Flora is *Carex aquatilis*, Wahl., a northern sedge reaching beyond the Arctic Circle, but coming south wherever the lines of temperature are combined with local conditions. When this was first recorded as a Scotch plant, doubt was expressed by our best botanists whether it was the plant of Wahlenberg, but there is no reason now to doubt this; specimens from Siberia, Lapland, and British North America are not distinguishable from Scotch specimens from the mountains; there is, however, a variety, *Watsoni*, that has often been mistaken for *C. acuta*,

that I have not yet seen from elsewhere. The Irish plant comes nearest to var. *Watsoni*.

Carex salina, Whlg., β . *kattogatensis*, Fries.—“Abundant in the Wick River, Caithness,” J. Grant. In August, 1883, Mr. Grant sent me a specimen, but I did not carefully examine it till last December. I sent it to Dr. Almquist, of Stockholm, who returned it named as above. *C. salina* is one of the most difficult of European Carices; some thirty names have been described under it as species, subspecies, or varieties, and the limitation of its forms is very difficult. The small group of Carices to which it belongs are natives of northern countries, reaching far beyond the Arctic Circle, and southward to the coast of Massachusetts, U.S.A., about 42° N. lat. This, although many degrees south of the British Isles, has less favourable climatic conditions. If you take the mean winter temperature of 40°, you will see how rapidly this rises as it approaches the British Isles; after passing over them and the Gulf Stream it then rapidly descends, striking the coast of America about Cape Hatteras, far to the south of Massachusetts. Then if you take the mean summer temperature of 60°, the difference is not so great; in Britain rising to about Edinburgh, then striking the American coast about Quebec, in Canada. Here, then, you have the requisites of a northern species, cold in winter and heat in summer; there are of course exceptions, as in everything else.

Now this form of *C. salina* grows in Norway on the west coast, and in the provinces of Bohuslän and Halland, in Sweden, in the former being plentiful about Goteborg, this being about 1° lat. further south than Wick; and I am prepared to hear of its being found at the estuaries of some of the rivers that fall into the Moray Frith, where its associates already are recorded, e. g., *Juncus balticus* and *Carex incurva*.

It will be noticed that most of the additions to our Flora of late years have been amongst difficult genera, *Juncus*, *Carex*, *Potamogeton*, &c. This may perhaps be accounted for by the fact that few botanists pass by an orchid, whilst many will pass by a rush, or sedge, or aquatic plant.

There are two or three other Scandinavian Carices that

will probably be found in Scotland, as *C. norvegica*, Gun., *C. helonastes*, Willd., &c.

Mr. W. H. Beeby read the following 'Notes on *Sparganium neglectum*, sp. nov., and other new Surrey Plants':—

I propose first to speak of the *Sparganium* which I have the pleasure of exhibiting this evening, and to conclude with some brief remarks on the recent additions to our Surrey Flora.

This Bur-reed was first noticed at Albury Ponds, near Guildford, in October, 1883. The plants then observed had the general habit of *S. ramosum*, but attracted my attention by their much smaller heads of fruit. On examination most of the fruits proved to be abortive, but the few partially ripe ones seemed to me to differ considerably from those of *ramosum*. Although the Albury plants were considered by others to be merely an abnormal condition of *ramosum*, I did not feel satisfied on this point, and was thus led to investigate the matter during the past year. In August I noticed, near Ockley and at Reigate, plants that seemed the same as the Albury one; and eventually, on obtaining specimens at Reigate, Blackwater, Byfleet, and various other places, in good ripe fruit, but small doubt was left that they represented a species hitherto undescribed and unnoticed as distinct from *ramosum*. This opinion has now been very generally endorsed by nearly all the British and continental authorities who have seen the plant; and I may notice that when I showed specimens at a meeting of the Linnean Society in December last, Mr. J. G. Baker, of Kew, stated that after careful examination of the plant he considered it undoubtedly distinct from all described species.

S. neglectum has various characters in common with *S. ramosum*, and these two species form a section very distinct from our other British species, *simplex*, *affine*, and *minimum*, which also group naturally together. *S. neglectum* and *ramosum* are both invariably characterised by a strikingly erect and rigid habit, and neither in small forms nor when growing in running water do the leaves show the slightest approach to a floating or even flaccid state. In both the branching of the inflorescence is identical, there being in both

a large and a small form,—the large form bearing 2–3 female heads on each branch, and the small form but 1 on each branch,—in each form the branch being continued beyond the female head, and bearing numerous male heads. The most marked difference between the two species is to be found in the ripe fruit, which in *neglectum* is obovate, with a very long beak, smooth, almost round in transverse section, or slightly obtuse-angular by compression; while in *ramosum* the fruit is obversely conical or pyramidal, with a short beak, very angular, and wrinkled between the angles, giving a very irregular transverse section. This difference in the external appearance of the fruit is due to the structure of the epicarp, or outer layer of the pericarp. In *S. neglectum* this is much thickened, and is composed of numerous, small, dense cells, which do not shrink when the fruit ripens, but remain compact, and conceal the angles of the endocarp. In *S. ramosum* the epicarp is thin, composed of a few large, loose cells, which in the ripe fruit shrivel up into the furrows of the endocarp, allowing the ridges of the latter to project, and thus giving to the fruit its well-known angled and wrinkled appearance.

These observations on the epicarp are not founded on a few examples, but on a very large number of sections cut from fruits collected in various localities. It should be stated that good, ripe fruit should be chosen for comparison, as unripe fruits that have been dried, or abnormal and imperfect fruits (which are of frequent occurrence), are liable to mislead unless the characters afforded by the perfect fruit of each species are first well grasped.

As may be seen by the examples shown this evening, the leaves of the two plants dry a very different colour. Those shown were collected about the same time, and were dried under precisely similar circumstances, side by side in a south window.

The leaves of *ramosum* dry a deep olive or blackish green, whilst those of *neglectum* assume a pale yellowish green tint. This difference is not always so striking as in the specimens before you, and may be partially due to soil; but there is always a decided difference to be observed. The leaves of *ramosum*, and especially the bracts, are also usually of a more

leathery, india-rubber-like texture, the leaves being but slightly keeled, while the bracts are mostly quite without a keel; while in *neglectum* the texture of the leaves and bracts is much more harsh, the keel being frequently distinct, even to the apex of the latter. Not having had any means of recognising the plants while in flower, I have not been able to make any observations in that respect; but localities have been noted in which both plants occur alone, and I hope to investigate the matter next summer.

The only other character to which I need draw attention is afforded by the female perianth-scales; in *neglectum* these are narrowly linear, with a much broadened, spathulate apex; whilst in *ramosum* they are ligulate, thinner and more membranous, scarcely or not at all enlarged at the apex. Those of the female flower are excellently shown in the plate in Curtis's 'Flora Lond.,' but, curiously enough, the *male* perianth-scales of *ramosum* in the same plate almost exactly resemble the female ones of *neglectum*. This I hope to verify this year. The form of these scales is liable to some variation; but the broad ligulate female scale is decidedly characteristic of *ramosum*, and the linear spathulate scale of *neglectum*.

As *S. neglectum* has been repeatedly referred to *S. simplex*, that is, has been considered to have affinities with that species rather than with *ramosum*, I will conclude this portion of my paper with a comparison of the two plants. On looking at a head of fruit of each of these, a very considerable outward resemblance is found in the pointed apex to the fruit and in its long beak, but here the resemblance ceases. The colour of the ripe fruit (a character which is of considerable value in this genus) is quite different, as also is the shape. In *S. neglectum* the broadest part is above the middle, and from this broad part the fruit slopes off gradually by straight or slightly convex lines to its base. In *simplex* it is about equally broad at top and bottom (oblong-fusiform, as Syme well calls it), with a slight constriction in the middle; the fruit is rounded below and then contracted, so that the basal lines show a concavity. The endocarp of *simplex* is much

softer, rather woody than stony, being composed of larger, less dense cells, and is also without prominent ridges. *S. simplex* has also not unfrequently long, semipellucid, floating leaves. A consideration of the characters afforded by the leaves and fruit led me to see that the genus falls naturally into two sections, and I afterwards found my conclusions only corroborated those of the American botanists, who follow a similar arrangement. The distinction made in some continental works founded on the sessile or stalked fruit is of little value, this being a character liable to great variation. I might say much more in detail, in support of the American system of dividing this genus into two new sections, did time allow of it.

Although the fruit of *S. neglectum* has some first-glance resemblance to that of *simplex*, owing to its pointed apex and long beak, the resemblance ceases there, the fruit being in reality of quite a different shape; and I think that the new plant has in all respects an affinity with *ramosum* rather than with any other species.

The distribution of the species is not yet ascertained, but it will probably be found to be widespread. In Surrey it seems to be more common than *ramosum*, and I have noted it in some dozen localities. In this neighbourhood it occurs near the Heath, and most profusely at Nutfield Marsh. Many of the plants in this last locality bore only abortive fruit, but it was in fine fruit last October in that part of the Marsh nearest the road from Merstham to Nutfield.

Mr. Beeby exhibited specimens of *S. neglectum*, and also of the ripe fruit of *S. neglectum* and *S. ramosum*. He also exhibited specimens of the following plants recently found in Surrey:—*Viola lactea*, Sm., more common in the West of England; *Stellaria umbrosa*, Opiz.; *Hypericum dubium*, Leers, which, though common in Hants, is unknown in Kent; *Sanguisorba officinalis*; *Potamogeton Zizii*, Roth.; *P. nitens*, Web., previously not found south of Northumberland, except in Anglesea; *P. decipiens*, Nolte; *Rhynchospora fusca*, Roem. & Schult., a west-country species; *Scirpus pauciflorus*, Lightf.; *Carex dioica*, Linn., a northern species, rare in the south; *C. fulva*, Good.

The President, Mr. W. H. Tyndall, read notes on "Meteorology, Oxford Road, Redhill, 1884."

In noticing the Meteorology for the past year, regard may first be had to the BAROMETER. For eight months in the year the average stood above 30 in., and for four months it was below that average. The observations were made at 8 a.m., and indicate the height of the barometer at Redhill at an elevation of just 300 ft. above sea-level. The maximum of the year was 30·63 in., on October 5th; the minimum observed at 8 a.m. was 28·88 in., on December 20th, but it did fall to 28·64 in. about 9 p.m. on January 26th; this was during a heavy gale from the S.W. For 220 days the barometer reached 30 in. and upwards; for 144 days it was under 30 in. and above 29 in.; for two days it fell below 29 in. It will be remembered that there were 366 days in 1884. A very rapid fall of the barometer occurred on December 20th, followed by a rapid recovery.

On the 18th, at 8 a.m., the barometer stood at 30·01 in.

„ 19th,	„	„	29·58 in.
„ 20th,	„	„	28·88 in.
„ 21st,	„	„	29·91 in.

the fall being 1·13 in. in two days, the rise 1·03 in. in one day. A heavy gale accompanied the variation.

THERMOMETER.—There was no severe cold during the year, and no day in which the thermometer did not rise above the freezing-point in some part of the twenty-four hours. January, usually the coldest month in the year, was remarkable for having only one frosty night, and then the thermometer fell only to 31°; this was on January 1st; the average temperature of January was 42·73°, more than $5\frac{1}{2}^{\circ}$ above the average of the month. February was also comparatively warm, the average of the month being 41·39°, or more than 2° above the mean as observed for fifty years; February was a colder month than January; there were ten frosty nights in the month. March was also slightly above the average, being 43·24° against the mean of 42° over fifty years; there were five frosty nights in March, the lowest temperature being 24·50° on the 2nd. April was cold; there were six frosty

nights, and the temperature fell to 27° on the 22nd; all the frosty nights occurred after the 19th, causing great damage to the fruit-trees, the blossoms of which had been tempted out by the unusual warmth of February and March; the average temperature of April was 44.5° , instead of 47.5° . May had only one frosty night, on the 6th, when the thermometer fell to the freezing-point; the average temperature of the month was about normal, 53.5° . In June, July, August, and September the thermometer never fell below the freezing-point. In October it fell to 32° on one night, in November on twelve nights, and in December on nine nights.

In regard to maximum temperatures, the thermometer recorded 70° and upwards on

6 days in May.			
8	„	June, and over 80° on 1.	
20	„	July, „	5.
14	„	August, „	11.
9	„	September.	
<hr/>			<hr/>
57			17

The temperature of June was a little under the average.

„	July	nearly 1° above	„
„	August	„ 3° „	„
„	September	„ 2° „	„
„	October	„ 1° below	„
„	November	„ 1° „	„
„	December	was about the average.	

A remarkable fall in the temperature occurred on August 25th. At 9 a.m. the thermometer stood at 70.5° ; at 1 p.m. at 55° ; it fell $15\frac{1}{2}^{\circ}$ in four hours. These sudden changes are more frequent in the N.E. States of America and in Canada; a difference of 30° and more has been observed in less than two hours.

RAIN fell on 168 days to the total amount of 23.08 in., quite 5 in. below the average of Redhill. The year was one of much drought, especially from March to August, both months inclusive. The smallest quantity fell in May, only .05 in.; the greatest quantity in the month in December, when 3.53 in. fell. October and November were short of rain, only 1.57 in.

in October and 1.38 in. in November. The heaviest fall in one day from 8 a.m. to 8 p.m. was on September 3rd, when 1.06 in. fell; but the heaviest continuous fall was on June 5th and 6th, when 1.12 in. fell. There were 16 days without rain from May 18th to June 2nd, 12 days without rain from June 10th to 21st, and 10 days from October 15th to 24th. Rain fell on 18 continuous days from November 30th to December 12th.

SNOW. — A shower fell about 10.30 a.m. on January 27th, equal to about .07 in. of rain. Snow fell again on November 30th and December 1st, equal to about .79 in. of rain. These were the only occasions in the year on which snow covered the ground. A slight shower fell on January 1st, equal to about .01 in.

WIND. — There was a heavy gale on January 23rd, pressure about 22.7 lbs., and again on January 26th. There were also strong winds on April 15th from E.N.E.; May 4th from S.W.; September 7th from S.W.; October 26th from W.; October 28th from S.W.; and on December 20th, to which I have already referred in calling attention to the rapid fall and rise of the barometer in connection with the gale.

Storms were few during the year; of the most stormy months January seems ordinarily to take the lead; then November, October, December, February, and March about equal; April, May, and June stand next; July, August, and September are comparatively quiet.

The following table, compiled by Mr. Robert H. Scott, President of the Royal Meteorological Society, will give an idea of the average tendency of storms in the respective months over a period of fourteen years:—

Jan., 70 storms.	May, 4 storms.	Sept., 18 storms.
Feb., 46 „	June, 3 „	Oct., 55 „
March, 45 „	July, 2 „	Nov., 58 „
April, 17 „	Aug., 11 „	Dec., 47 „

Some days appear remarkable for storms. In the 14 years 6 storms came on Jan. 1st. 4 on March 6th, 9th, & 12th.
 5 „ „ 18th. 5 „ Nov. 10th.
 5 „ „ 19th. 5 „ „ 20th.
 5 „ Feb. 22nd. 4 „ Oct. 21st & 22nd.

LIGHTNING was seen and thunder heard about 5 p.m. on January 20th, during a heavy gale; again on April 3rd, at night. Thunder was heard on May 4th and 5th; on June 6th, 8th, and 29th; and on August 8th, 9th, and 10th; but no great thunder-storm occurred during the year, and it may be remarked that the neighbourhood of Redhill is not visited by severe thunder-storms, as is the neighbourhood of Clapham and the valley of the Thames.

Though there were several hot days during the summer, the heat was by no means unprecedented; the summers of 1846, 1847, 1852, 1857, and 1859 were all warmer; and in other years, 1851, 1858, 1866, 1868, 1870, and 1876, the summer-temperature was about the same as last year. Nor has the drought been very unusual. Persons feel the inconvenience of present want or scarcity of water, and think there has been nothing like it before; the inconveniences of the past are happily forgotten. The summers of 1844, 1847, and 1870 were all drier than the past year.

Mr. C. L. Prince, of Crowborough, has been good enough to send me his Meteorological Report for 1884, from which I have gathered the remarks immediately preceding. It seems more rain fell at Crowborough during the year than at Redhill. He collected 28·16 in. against only 23·03 in. at Redhill. Crowborough is 828 ft. above the sea-level. At Uckfield, about seven miles distant from Crowborough, but in the valley, only 23·16 in. fell, while on higher ground about five miles distant from Crowborough, at Maresfield, 26·16 in. fell.

Mr. James B. Crosfield remarked that our rainfall for 1884 was considerably in excess of that in London, while our temperature had as usual been two or three degrees lower.

EVENING MEETING.—APRIL 17TH, 1885.

Mr. T. P. Newman described two phenomena noticed by him on March 28th, 1885. On the afternoon of that day Mr. Newman saw a miniature whirlwind travelling across an open field, there being no obstruction nearer than some leafless trees, which were three hundred yards distant. It

METEOROLOGY. — OXFORD ROAD, REDHILL, SURREY (1884).

Month.	BAROMETER.				THERMOMETER.						RAIN.	
	Max.	Date.	Min.	Date.	Max.	Date.	Min.	Date.	Average.		Total of Month.	No. of Days '01 fell.
									Max.	Min.		
Jan. .	30.59	16 & 17	29.10	28	54.0	30	31.0	1	47.11	38.34	2.94	18
Feb. .	30.46	3	29.50	1	53.5	13	25.5	29	46.67	36.10	2.00	16
March	30.16	25	29.22	11	63.2	15	24.5	2	50.58	35.91	1.87	12
April.	30.06	12 & 14	29.41	5	65.5	2	27.0	22	52.98	36.00	1.56	14
May. .	30.45	22	29.46	4	79.0	24	32.0	6	63.55	43.44	0.50	8
June .	30.33	15	29.55	7	83.0	28	41.0	1	67.78	48.50	1.81	8
July .	30.26	1	29.74	10	83.5	4 & 9	42.0	25	73.82	52.07	1.55	18
Aug. .	30.30	5	29.72	29	87.0	8 & 11	44.0	16	76.27	51.73	1.18	11
Sept. .	30.40	18	29.44	4	79.0	17	42.0	26	66.72	50.40	3.14	17
Oct. .	30.63	5	29.58	9	65.0	16	31.0	13	56.03	41.30	1.57	15
Nov. .	30.51	10	29.74	21	60.0	2	25.0	24	46.90	35.80	1.38	13
Dec. .	30.16	10,13,27	28.88	20	54.0	3 & 13	26.0	30,31	44.23	36.30	3.53	18
Year.	30.63		28.88		87.0		24.5				23.03	168

advanced in a straight line, whirling leaves to a height of sixty feet with a distinctly circular motion. At about eleven o'clock in the evening of the same day Mr. Newman noticed three great belts of light, like fine, thin cirrus, stretching in parallel lines across a clear sky, their direction being from the N.E., the same quarter from which the wind blew. The moon was in one of the belts, and appeared as in a haze. No change of weather followed, fine weather continuing for some days.

Mr. Albert J. Crosfield then read the following paper on 'The Geographical Distribution of Wild Plants in the British Isles' * :—

The late Mr. Hewett C. Watson, of Thames Ditton, the father of British Topographical Botany, has divided the whole species of British plants into six types of distribution, at the same time placing a few species under none of the six well-marked types, but referring some to a place intermediate between types 3 and 4, and describing a number of our rarest plants as "local species." Thus he dealt with our well-established plants, numbering between 1400 and 1500 species; but, besides these, many are included in our botanical hand-books which are colonists or aliens. The six types are:—(1) British; (2) English; (3) Scottish; (4) Highland; (5) Germanic; (6) Atlantic; and we will describe them in turn.

1. BRITISH.—532 or about one-third of the plants making up the British flora are spread through the length and breadth of the land, though to some extent varying in abundance, in accord with variations in soil, elevation, and aspect. Most of these are spread over the whole Continent of Europe, and, with six or seven exceptions, they are all found in Ireland. That many plants are able to adapt themselves to very different conditions no one will doubt who has seen *Oxalis Acetosella* and *Adoxa Moschatellina* carpeting the shady woods in Surrey, growing also on the summits of the Yorkshire Fells, wherever a few yards of mountain limestone crop out

* This paper has been revised with the aid of the 8th edition of the 'London Catalogue,' supplemented by information kindly furnished by Mr. Arthur Bennett.

amongst the surrounding peat. On the same mountain limestone-caps, at an elevation of 1000–1500 ft., *Cardamine pratensis* abounds; not growing, it is true, to the height it reaches in our meadow-trenches; but, though stunted in height, it is sturdy in growth, and evidently has no idea of extermination. *Caltha palustris* likewise ranges from Cornwall to the Orkneys, and from sea-level to 3000 ft. elevation.

2. ENGLISH. — Over 400 species are more or less abundant in England, especially in the southern and midland counties, but becomes rarer as the Scotch border is approached; some of them reaching no further north than Yorkshire or Westmorland, whilst others are spread in small numbers through the lowlands of Scotland, or struggle even so far as Forfar and Aberdeen. These are plants of the great Central European plain. It may be of interest to mention the range northward of some of the wild flowers which abound in Surrey, and which belong to the English type of distribution.

Viola odorata is a plant of the English type, reaching Yorkshire and Westmorland, but being an alien in the lowlands of Scotland.

Acer campestre, *Asperula cynanchica*, *Cnicus acaulis*, *Chlora perfoliata*, *Verbena officinalis*, *Lamium Galeobdolon*, *Euphorbia amygdaloides*, *Spiranthes autumnalis*, *Cephalanthera pallens*, *Iris fetidissima*, *Colchicum autumnale*, *Tamus communis*, *Sagittaria sagittifolia*, and *Butomus umbellatus* are examples of plants of the English type of distribution whose northern limit is found between the Humber and Cheviots. It will be noticed that many of these are chalk-loving plants, and the absence of chalk in Scotland is doubtless one of the causes of their not having spread northward.

Amongst those which occur in Scotland, but so sparingly as not to entitle them to rank as of the British type of distribution, may be mentioned *Genista tinctoria*, *Campanula Trachelium*, *Scabiosa columbaria*, *Lactuca muralis*, *Solanum nigrum*, *Linaria minor*, and *Nephrodium Thelypteris*.

The 3rd type of distribution is the SCOTCH, which is just the converse of the English; that is to say, it comprises plants which are most numerous in Scotland, some of which

cross the border, but become less abundant in the northern counties of England or are absent from them. These northern plants spreading southward are less numerous than the southern species that spread northward. About 40 come under this heading, and few of these are found in Surrey; though one or two reach the southern coast, such as *Habenaria albida* in Sussex, and *Polypodium Dryopteris* and *Phegopteris*, the range of which extends to Cornwall.

The greater number of plants characteristic of Scotland (about 200) are referred to the 4th type, the HIGHLAND; but these reappear for the most part on the Welsh Mountains. Many of these species are found also on the mountains of Scandinavia, some extending eastward to the Alps, the Himalayas, and the Rocky Mountains.

About 30 species *intermediate* between the Scotch and the Highland types of distribution are found mainly in the mountainous regions of the north of England, nearly all of them occurring in that remarkably rich district, Upper Teesdale, on the borders of Durham, Westmorland, and Yorkshire. Many of these are plants of special interest and beauty, and I cannot forbear naming some of them. *Aquilegia vulgaris* and *Polemonium caruleum* are well known in gardens (the former reaches south to Surrey), and *Potentilla fruticosa* is sometimes grown. Amongst the surprises of plant-distribution is the appearance of this last-named by the Tees-side, where it forms a bush several feet in height, with yellow blossoms. It grows also in the West of Ireland, as well as through North and Mid-Europe, Siberia, and the Himalayas, and on basaltic rocks on the shores of Lake Superior, and amongst the Rocky Mountains. The yellow *Saxifraga Hirculus* is another Teesdale rarity; but the chief beauties of the intermediate type are *Primula farinosa* and *Gentiana verna*. No lover of plants who has seen these sprinkling the grassy banks as daisies sprinkle our lawns can recall them without enthusiasm.

5. GERMANIC.—About 130 species which might otherwise be described as English are very much restricted in their range to the eastern counties, some of them not extending at all beyond the eastern counties, others occurring abundantly in

the eastern counties and becoming scarce westward. Eighteen of them occur in Ireland, but only five of them reach the west coast of Ireland. The title Germanic has reference only to their distribution in the British Isles, and has no reference to any supposed centre on the Continent from which the species may be thought to have spread. Amongst these is *Clematis Vitalba*, which ranges north-westward only as far as Stafford and Denbighshire. They include two Hellebores, four *Silenes*, three *Galiums*, eight Umbelliferous plants, seven *Leguminiferæ*, and fourteen *Orchidaceæ*.

6. ATLANTIC.—Conversely, about 70 species are at home in the western counties, and absent from the eastern or occurring in greatly reduced numbers as the eastern sea-board is approached. Amongst the best known of this type of distribution are *Rubia perigrina* and *Crithmum maritimum* (which grow sparingly as far east as the Kentish coast); *Wahlenbergia hederacea* and *Scutellaria minor* (abundant in parts of Sussex), *Asparagus officinalis*, *Asplenium marinum*, and *Adiantum Capillus-Veneris*. Amongst the most recent additions to the flora of Surrey is *Rhynchospora fusca*, a sedge belonging to the Atlantic type of distribution, the bogs of West Surrey being its easternmost limit in England, although it is found in North Europe as well as in N.E. America. Many of these plants of the Atlantic distribution are moisture-loving species, common to Portugal, Asturias, and the Biscay coasts of France, and more than half of them occur in Ireland.

Having thus roughly accounted for about 1500 species, we have now to deal with the rarities of *local* distribution.

These suggest problems very hard to solve. Which of these are survivals of a species once abundant? and which are aliens that have gained a footing through the seed or roots being carried to the station where the plants are now found?

The number of species recorded for *one* county only is 81; for two counties only, 46; including representatives of most of the natural orders. As we should expect to find, the counties in which most of these rarities occur are on our sea-board.

Cornwall, Devon, and Somerset contain 32 out of the 173

records; whilst Scotland contains 46; Wales, 10; the south-coast counties, Dorset to Kent, contain 26; the eastern counties, Lincoln, Norfolk, Suffolk, Cambridge, and Essex, 17; the six northern counties, 13; Shropshire, Hereford, Monmouth, Gloucester, Worcester, Wilts, Oxford, Middlesex, and Surrey, amongst them, 26; leaving to the Midlands but 3 records, which occur in Derbyshire, Warwickshire, and Bedfordshire.

Here we seem to trace pretty clearly two distinct classes, Highland and Sea-board. Scotland, Wales, and the hilly parts of Durham, Yorkshire, Westmorland, and Derby contain local plants of the Highland type; and it is likely that these once flourished at a much lower level than at present, and that *Cystopteris alpina* and *Polygala austriaca* var. *uliginosa* in Upper Teesdale, amongst others, are remnants of a flora once far less restricted. But then we have a second station for *P. austriaca*, on Wye Down, in Kent, near the sea-board, and it is impossible to assign any reason why these two stations, separated by 200 miles, should be the only stations for it. Is it fair to regard it in Yorkshire as a survival, and in Kent as an alien or a colonist? Amongst other agents checking the growth of these plants at lower elevations may be the ravages of slugs, from which we may suppose them to be fairly free on the wild hill-tops where they now flourish. I have noticed *Viola arenaria*, *Myosotis alpestris*, and *Polygala uliginosa*, all attacked by slugs in my garden.

Turning to Cornwall, with its large flora of local rarities, are we to regard them as sheltering in the peninsula, like the Druids of old, after being chased by the advance of civilisation out of the rest of England? or is it not more likely that *Erica vagans*, the three *Trifoliums* (*Molinerii*, *Bocconi*, and *strictum*), the two *Alliums* (*sibiricum* and *triquetrum*), the two *Junci* (*capitata* and *pygmaeus*), and other Cornish rarities are rather seeking to gain a footing in our island, and are now effecting an entrance through our southernmost county? Perhaps the advance of some of them has been checked by more severe cold as they have tried to spread north-eastward.

So with other south-coast plants, such as *Gladiolus com-*

munis in Hants, *Phyteuma spicatum* in Sussex, *Pulmonaria angustifolia* in Hants and Dorset, and *Orobanche caryophyllacea* on the undercliff between Dover and Folkestone.

On the other hand, *Spiranthes æstivalis* growing in bogs in Wye Forest, Worcestershire, and in the New Forest, Hants, looks like an old-established native, whose area has been encroached upon by cultivation till it is only found lingering in these undisturbed wilds.

Orchis hircina in Suffolk and Kent would seem to be a species maintaining a struggle for existence in face of the destruction of one site after another suited to its growth.

Who can decide to which class to refer *Teucrium Botrys*, found in three spots in Surrey, in rough, stony valleys on a chalk soil? Perhaps its occurrence in Belgium favours the idea of its being a colonist in Surrey. On the other hand, the fact that it is being choked by coarser herbage, through the ground having been planted with larches in the Box Hill station, suggests the thought that when there was more rough, stony ground in Surrey it would have a chance of holding its own in other parts of the county, and that it may have shared elsewhere the fate that seems to threaten its existence in that valley.

Lilium Martagon in the copse in Headley Lane, Surrey, may be regarded as an outcast from some cottage-garden, although it has been pretty well-established there for many years.

The number of aliens sufficiently established to find a place in the 'London Catalogue' (1886 edition) is 200.

The spread of some of these plants through England has been very rapid. *Veronica Buxbaumii* is a well-known example of this.

One foreign weed has established itself abundantly in the Reigate district since the Flora was published (in 1856), *Erigeron canadensis*, in the sandy fields between Reigate and Redhill.

In 1882 *Lathyrus hirsutus* and *Vicia lutea* both appeared in a fallow field at Nutfield, having doubtless been introduced with seed from abroad. The occurrence of *Lathyrus hirsutus*

in Essex was recorded as long ago as 1666, and so recently as 1860 Essex was the only county in which it was known. In a locality near Caterham it is protected by growing on the edge of a field, amongst a few small bushes, but its hold is precarious.

Examples may be cited of plants that have established themselves and held their own for many years, such as *Impatiens fulva*, a North American plant, which appeared on the banks of the Wey at Guildford at least fifty years ago, and is still spreading; *Trifolium stellatum*, which has been confined for forty years or more to one station on the side of Shoreham Harbour, where it extends for about thirty yards; it probably came there with foreign ballast; *Lepidium Draba*, which is said to have got a footing in Kent when chaff-mattresses used in the Walcheren Expedition were demolished; it grows freely on railway-banks, both in the South Eastern and Midland Counties, so most likely it has been re-introduced many times with Russian Oats.

Ornithogalum nutans is a plant less likely to spread. Three or four plants of it have grown for thirty years or more on a high sandy bank at Redhill. How they got there I cannot tell.

Galinsoga parviflora, a Peruvian composite, has established itself in the roads about Kew.

A more interesting case, because rather more remote, is that of *Linaria Cymbalaria*, a European plant, now spread through this country on old walls as far north as Perth. I am told by Dr. Bossey, on the authority of Mr. Anderson, the Chelsea gardener whom he knew fifty years ago, that this toadflax started from the Chelsea Botanic Gardens fully a century ago. Even within my memory it has very much increased in our neighbourhood.

A striking feature in the flora of Great Britain, and indeed of Europe generally as compared with America, is the paucity of species of forest-trees. In Great Britain we can only reckon up fifteen species of indigenous forest-trees, and eighteen smaller trees. Of these thirty-three, only nine extend southward into North Africa. Prof. Asa Gray, in his recent address at Montreal, spoke of the Mediterranean as

the barrier which cut off the northward advance of southern forms at the close of the glacial epoch; and if an ocean further covered the Sahara and the plains of Central Asia, we can well understand the entire absence from England of South African and South Asiatic types of trees.

That there has been a very large influx of plants into this island in the course of centuries we have evidence when we compare the flora of Great Britain with that of Ireland, the total number of species in Ireland being barely 1000, or only about two-thirds of the number found in Great Britain.

Let me quote, in conclusion, a paragraph from an address by J. Gilbert Baker, F.R.S., given to the Yorks. Nat. Union at Selby, on March 3rd, 1883. He says:—"Upon the general question of evolution, an important light is thrown by studying the flora of Britain in comparison with that of Continental Europe. The most important general character of the British flora is its utter want of any distinctive individuality. Leaving out of count a few doubtful *Hieracia*, Willows, *Rubi*, and Roses, I can give only two good instances of British plants that do not occur in Continental Europe. One of these, *Potamogeton lanceolatus*, is known in Cambridgeshire, Anglesea, and the North of Ireland; the other, *Eriocaulon septangulare*, is found in Skye and Galway; and, across the Atlantic, it is widely spread in North America. It is now generally believed that Britain was last separated from the Continent towards the close of the glacial period.

"I do not think any competent authority would consider that it was an extravagant suggestion that Britain may have been an island for a hundred thousand years. If, then, out of 1400 species which it produces, not one is distinct, this is a very significant fact."

Mr. Crosfield exhibited specimens of many of the rare plants named in his paper.

Mr. N. E. Brown, of Kew, remarked that our flora is an insular flora. Insular floras are of three types—recent and ancient continental island floras, and oceanic island floras. (1) Those in islands of comparatively recent date, separated from the mainland by seas under 100 fms. in depth; (2) in islands surrounded by deep seas, such as those of Madeira,

Canaries, Madagascar, &c., which have been separated from the Continent from remote time; (3) in islands such as St. Helena, surrounded by seas of enormous depth, which, if ever joined to any continent, have been separated from vastly remote time.

In Great Britain we find longitudinal and latitudinal distribution of plants. Some of the plants confined to our eastern counties would grow on any soil, so we may regard them as later introductions, which may be expected eventually to spread westward. At the close of the glacial epoch there can have been no flora in our island, except an Arctic flora.

The plants peculiar to Ireland probably entered Ireland from the south, before or after Ireland became separated from England, and before the final separation of Ireland from the Continent to the south; or they may possibly have crossed England and become exterminated in Great Britain, although this is less likely. Ireland was doubtless separated from England before England became separated from the Continent.

Two North American species found in Ireland, *Eriocaulon septangulare* (found also in the Hebrides) and *Spiranthes Romanzoviana*, can scarcely have been introduced by man's agency; they must have been in Ireland long before the discovery of America in the 15th century.

This presence in Ireland of *Arbutus Unedo*, *Saxifraga Geum*, and *S. hirsuta*, found elsewhere only in the Pyrenean district, seems to imply a former connection of Ireland with Spain.

The Rev. H. Brass remarked on Prof. Forbes' division of the British flora into the following five types:—Scandinavian, Gallic, Germanic, Norman, and Lusitanian.

ANNUAL GENERAL MEETING, OCTOBER 16TH, 1885.

The Annual Report and Balance Sheet were read and adopted, as follows:—

HOLMESDALE NATURAL HISTORY CLUB.

Annual Report, October 16th, 1885.

The membership in the Club has suffered during the past twelve months from removals; whilst six new members have

joined, sixteen have left the Club, leaving a present membership of sixty-six. Messrs. Sydney Webb, of Dover, and N. E. Brown, of Kew, have been elected Honorary Members, in recognition of valuable services rendered to the Club.

The following papers were read or addresses given at the evening meetings during the winter:—

- Oct. 17, 1884. 'The Development of Starch Granules,' by Mr. N. E. Brown.
- Oct. 17. 'Continuity of Protoplasm,' by Mr. N. E. Brown.
- Oct. 17. 'Notes on Italian Switzerland,' by Mr. H. M. Wallis.
- Nov. 21. 'Atmospheric Dust as related to Fermentation, Putrefaction, the Growth of Plants, and the Production and Spread of Infectious Diseases,' by Dr. Bossey.
- Nov. 21. 'The Physical Geography, Flora, and Fauna of Iceland,' by Mr. J. Backhouse, jun.
- Dec. 19. 'Natural History Notes on Jersey,' by Mr. Edwd. Lovett.
- Jan. 16, 1885. 'The Physical Features and Flora of the Great North West,' by Mr. H. T. Mennell, F.L.S.
- Feb. 20. 'How and Why Animals Differ,' by Mr. H. W. Gilbert.
- Feb. 20. 'Wind and Storm,' by Mr. T. P. Newman.
- March 20. 'Recent Additions to the British Flora,' by Mr. Arthur Bennett, F.L.S.
- March 20. 'Notes on *Sparganium neglectum*,' by Mr. W. H. Beeby.
- March 20. 'Notes on Meteorology for 1884,' by Mr. W. H. Tyndall.
- April 17. 'The Geographical Distribution of Wild Plants in the British Isles,' by Mr. A. J. Crosfield.

The attendance at the ordinary evening meetings averaged twenty-four, whilst at the February meeting, to which young persons were specially invited, about one hundred were present. The papers and addresses were of great interest, and the character of the Club was well maintained.

Six whole day and six afternoon excursions were arranged as under, a pleasing feature of two afternoon excursions being

a union for the occasion with the Croydon Microscopical and Natural History Club :—

Whole day.

- May. 2. Leith Hill.
- June 6. Worth and Tilgate Forest.
- July 4. Edenbridge, Botley Hill, and Oxted.
- Aug. 8. Gomshall and Ewhurst.
- Sept. 5. St. Leonard's Forest and Slaugham Castle.
- Oct. 10. Edenbridge, Dry Hill, and Forest Row.

Afternoon.

- April 18. Flanchford, Ewood, and Holmwood.
- May 16. Ranmore Common.
- June 20. Reigate Heath to Walton Heath.
- July 18. Guildford and Shalford.
- Aug. 22. Merstham and Pendell Court.
- Sept. 26. Addington Hills.

On April 18th, during the afternoon excursion, the Wood Spurge, Blackthorn, Wild Cherry, Wild Hyacinth, and Wood Sorrel were found in flower; Swallows were seen, and the Cuckoo, Tree Pipit, and Willow Wren heard.

From the River Wey, between Guildford and Shalford, a Rotifer was obtained in abundance, and identified as *Megalotrocha albo-flavicans*. In the bog at Shalford *Isolepis setacea* was found.

On the occasion of the excursion to Gomshall and Ewhurst *Impatiens fulva*, *Anagallis tenella*, *Sium angustifolium*, *Sagina nodosa*, *Glyceria aquatica*, and *Pedicularis palustris* were found in the bog near Gomshall station; *Antirrhinum Orontium* and *Anthemis arvensis* were gathered in fields between Gomshall and Ewhurst; and *Nitella opaca* was collected from a pond at Peaslake, showing the movements of protoplasm very admirably.

On August 22nd Sir George Macleay most kindly threw open his grounds near Bletchingley to the members of the Club. From a pond in his garden forty species of Diatoms were identified. A plant of *Stapelia gigantea* was pointed out

in Sir George Macleay's greenhouse, probably the only living specimen now in England.

On September 26th living specimens of *Hydra fusca*, *Floscularia ornata*, *Linnias*, *Ceratophylli*, and *Stentors* were found in the pond in Addington Lane, Croydon; and many Desmids and Diatoms were found in the lake in Addington Park. On Addington Hills many species of Fungi were obtained, including splendid specimens of *Agaricus* (*Amanita*) *muscarius*.

ABSTRACT OF ACCOUNTS.

<i>Receipts.</i>			<i>Expenses.</i>		
	£	s. d.		£	s. d.
Oct. 1885.			1883 & 1884.		
Balance	42	0 7	Rent of Museum to		
1885.			June, 1885	15	15 7
Subscriptions	29	6 0	Cleaning, &c.	1	2 0
Sale of 'Proceedings'.	0	12 0	Printing of 'Proceedings'	26	17 9
			Collector's Commission		
			and Stamps	1	13 6
			Printing, &c.	2	6 5
			Oct. 1885.		
			Balance in hand	24	3 4
	£71	18 7		£71	18 7

Examined and found correct, { WM. H. TYNDALL. }
 October 16th, 1884. { FRANCIS BOSSEY. } *Auditors.*

The following gentlemen were elected as Officers for the ensuing year:—*President*, Mr. W. H. Tyndall; *Treasurer*, Mr. T. P. Newman; *Secretary*, Mr. Albert J. Crosfield; *Curator*, Mr. John Linnell; *Committee*, Dr. Bossey, Messrs. T. L. Aspland, F. G. Carey, T. Cooper, J. B. Crosfield, J. I. Cudworth, H. W. Gilbert, Rd. Noakes, and the Rev. James Menzies.

The thanks of the Club were voted to Mr. R. C. Baxter, for his valuable services as *Treasurer* to the Club during a period of sixteen years.

Mr. T. P. Newman exhibited a specimen of *Pyrethrum uliginosum* very greatly fasciated. He remarked that this species is very subject to fasciation, but that fasciation has not been so abundant this year as last.

Mr. R. Miller Christy remarked that fasciation consists of a number of buds joined together. Plants belonging to the

natural order *Compositæ* are specially liable to it. He once counted 255 flowers on one stem of *Primula elatior*, and 67 flowers on a stalk of Easter Lily.

Mr. T. Cooper exhibited a fasciated Pansy and a fasciated Chrysanthemum. He also showed plants of two *Stapelias*, and a *Mesembryanthemum* allied to *M. nuciforme*.

Mr. R. Miller Christy proceeded to describe "The Yellowstone National Park," which he visited recently.

The Park is 65 miles long, by 55 broad, and consequently contains about 3575 square miles, or about the area of Lancashire. It is mostly situated in the Territory of Wyoming, and lies amongst the Rocky Mountains, at an elevation of over 6000 ft. Nothing was known of the Yellowstone National Park prior to the year 1863. In 1871 the United States Government sent Prof. Hayden to explore the Park, and on his report the Park was nationalized, no settlements being allowed in it. The land would be useless to settlers, as there are frosts every night of the year, and the rock is volcanic.

It contains more geysers and hot-springs than all the rest of the world. Not even the geysers of New Zealand can compare with those of the Park. Its boiling springs number 10,000, and of its geysers fifty spout to a height of from 50 to 300 ft. The railway-terminus is at Cinnabar, eight miles to the north of the Mammoth Hot-Springs. These seen from afar look like a gigantic glacier, from the vast snow-white calcareous deposits which lie in terraces on the valley-side, 1000 ft. above the Gardiner River, rising 200-300 ft. high. In most of the springs the water is iridescent, and the temperature of some reaches 180° Fahr., at which heat water boils at that elevation.

Most of the Park is covered with dense Pine-forest. Some twelve miles south of the Mammoth Hot-Springs are obsidian cliffs from 150 to 250 ft. in height, and 1000 ft. in length. At their foot is the Lake of the Woods, on whose banks remain clear traces of Beaver-dams. Six or seven miles further south is Norris Geyser Basin, in which are twenty geysers and upwards of 1000 boiling springs. "Gibbon

Paint Pot Basin" is remarkable for the varied shades of colour of the mud-holes, green and red being most prevalent. In the Lower Geyser Basin (7250 ft. above the sea) is the Fountain Geyser, which spouts twice a day. The Midway Geyser Basin contains the Excelsior Geyser, the largest in the world; it "plays" twice a day, rising to a height of 300 ft. in a column 75 ft. in diameter from a pit 300 ft. by 200 ft., and 20 ft. deep; the noise and commotion can be heard at a distance of two to three miles.

Towards the S.E. of the Park is the Yellowstone Lake, at an elevation of nearly 8000 ft. above the sea-level. Its area is about 150 square miles. It is surrounded by dense Pine-forests, and the islands in the lake are thickly wooded. Trout are prodigiously abundant; they are subject to a parasitical, intestinal worm, which eats into the flesh. In the month of June Mr. Christy found the Mosquitos almost unendurable.

Within five miles of the Lake is the Natural Bridge, which spans a mountain-gorge. Some miles below the Lake the Yellowstone River rushes over the Upper Falls, 112 ft. in height; and half a mile further on its course takes a plunge of 300 ft. over the Lower Falls down into the depths of the Grand Cañon, a gorge twenty-one miles in length cut by the river out of volcanic rock. Its walls are brilliantly coloured, and afford nesting-places for Eagles and Ospreys.

On the side of the Amethyst Mountain, on the east fork of the Yellowstone River, are fossil forests. Some of the trees are standing *in situ*, and are a yard in diameter and 20 ft. high, whilst prostrate trunks 50 or 60 ft. long are not uncommon.

EVENING MEETING.—NOVEMBER 20TH, 1885.

Mr. Noakes exhibited specimens of *Trifolium ochroleucum*, collected between Hertford and Bayford in July.

The Rev. James Menzies brought a specimen of *Calluna vulgaris* var. *alba* from Scotland.

Mr. W. H. Tyndall read a paper on 'Mahogany—Where grown—How obtained—Its quality and uses.'

Mahogany is a native of Central America and the larger islands in the Caribbean Sea, lying between the latitudes of 11° and 23° N. There is a kindred tree which grows in Africa, and also one in India; but the wood in each case is in many respects of inferior quality, though harder and more compact than Mahogany. The finest Mahogany is obtained from Cuba, and is called Spanish Mahogany. In Jamaica it has become scarce, from the districts near the coast having been cleared, and the hill-country being difficult of access. It has been to a great extent cleared from the Bahamas.

The Mahogany tree is one of the largest and most stately of tropical growth. Its trunk is not unfrequently 50 ft. in length and 12 ft. in diameter breaking into branches and arms. The leaves comprise three or four pairs of leaflets, and in the month of August they turn to an orange hue, of which advantage is taken by those who are in search of the timber. The fruit is about the size and shape of a large Victoria Plum, and contains numerous seeds arranged in spiral form round a centre. These seeds are winged, and are carried by the wind to a considerable distance. They readily take root in almost any soil.

The tree will flourish in wet, marshy ground, or in rich alluvial soil, or in a rocky country; but the wood grown on a wet soil is lighter in colour and less close-grained than that grown on alluvial soil, and that grown on alluvial soil is less weighty and softer than that grown on rocky ground. It grows in dense forests, so that gangs of men are employed to cut a path through the tangled undergrowth before the trees can be reached. When felled and squared they are dragged on wheels through roadways cut through the forest till some stream is reached, where the logs await the tropical rains of May and June to float them to the sea-coast. Logs of commerce are not often more than 2 ft. in the square, though occasionally nearly 3 ft.; their length varies from 5 ft. to 25 ft. or more.

The beauty of Mahogany was known in the latter part of the 16th century, and recognised by the ship-carpenter of Sir Walter Raleigh when in the West Indies; but it does not

appear that the wood was introduced into England until the middle of the 18th century, when it was brought into notice by Dr. Gibbons.

In the discussion which followed Mr. Henry Brady remarked that Teak is being planted in Java, and is ready to fell in about thirty years, when about 18 in. in diameter.

Dr. Bossey showed the structure of three sub-orders of British Ferns, by exhibiting their capsules under the microscope.

Polypodiaceæ is characterised by capsules pellucid, reticulated, surrounded by an elastic ring, opening irregularly or tearing open when ripe.

Osmundaceæ. — Capsules pellucid, reticulated. Ring less perfect. Capsules opening regularly into two halves.

Ophioglossaceæ. — Capsules opaque, coriaceous, split into halves; no elastic ring.

Mr. T. Cooper made some remarks explanatory of "Fasciation."

The growth of plants depends on cell-division and multiplication of cells. The highest cell, known as the mother-cell, is more active than those below it. Stems may unite through pressure during the act of growth, resulting in a living grafting. Protoplasm may burst the cell-wall and join two cells into one.

Mr. Cooper exhibited numerous specimens of fasciated plants. He stated that wrinkles on a frond of *Scolopendrium vulgare* were caused by unequal development of cells. Double flowers he defined as those whose normal number of petals was increased by the transformation of pistils or other parts into petals. Some Chrysanthemums do not come under this heading, as the change is only florets becoming ligulate florets.

EVENING MEETING.—DECEMBER 18TH, 1885.

Dr. Bossey and Mr. A. J. Crosfield exhibited specimens of *Salvia verticillata*, gathered from one plant found by Dr. Bossey last July on the side of the road leading eastwards from Merstham towards Rocks Shaw.

Mr. W. H. Beeby showed on a map of England the distributions, so far as yet worked out, of *Sparganium ramosum* and *S. neglectum*. *S. neglectum* has been identified from Shropshire, Warwick, Worcester, Oxford, Hants, Surrey, and Sussex; whilst specimens from the eastern and northern counties have proved to be *S. ramosum*. Mr. Beeby stated that the filaments of the stamens in *neglectum* seemed generally to be longer than in *ramosum*; and the stigma (apart from the beak) to be shorter in *neglectum*.

Mr. Arthur Bennett, F.L.S., read the following notes on 'Recent Additions to the British Flora':—

In *Hieracia* I can do no more than mention three species that will probably prove British:—*H. onosmoides*, Fr., a native of S. Norway, Sweden; and rare in France. *H. æstivum*, Fr., a native of S. Norway, and rare there. *H. oreodes*, Fr., a native of S. Norway, and Mid and South Sweden. Mr. Backhouse and Prof. Babington both considered them to be new to Britain, and recommended my sending them abroad; so I have sent them to Dr. Almquist, of Sweden, the second authority in Scandinavia on this genus.

Schœnus ferrugineus, Linn.—Found in damp, heathy ground near Loch Tummel, in Perthshire, by Messrs. White and Brebner, in July, 1884 and 1885. It is distributed over a large part of the Continent of Europe, but is local and is wanting from large areas. It occurs in Norway, Sweden, Denmark, Mecklenburg, France, Switzerland, Austria, and Mid Russia, but is not known out of Europe. This species will probably occur elsewhere.

Carex salina, Wg., β . *Kattegatensis* (Fr.), Almquist. — Of this sedge I was able to supply last year only a single specimen. Mr. Grant has found it this year in great abundance by the Wick River, in Caithness; in one place in such abundance that a cart-load might be mown without any trouble.

Growing with the *Carex salina* and *C. aquatilis* var. *Watsoni* another sedge was found last July by Mr. F. J. Hanbury, which with careful examination I separated as *C. aquatilis* var. *cuspidata* of Læstadius, a form found in Lulea, Lapland, by Læstadius, and in Western Bothnia by Lundberg.

Mr. Hanbury also collected a fine series of *Carices* from Aberdeen and Forfar, especially of *aquatilis* and *rigida* from the Little Culrannoch, in the latter county. Among them I found specimens of *Carex rigida* var. *inferalpina* of Læstadius, a variety found in the higher alpine regions of Lapland. Since then I am glad to be able to say that Dr. Almquist, who possesses type-specimens of both from the author, confirms my naming of the specimens.

Calamagrostis strigosa, Hartm. "Stivhaaret Ror," Stiff-haired Reed. — Gathered in marshy ground, formerly Loch Duran, near Castleton, in Caithness, by Mr. James Grant, of Wick. It is a native of Finmark, Lapland, and N. Norway.

Sir J. D. Hooker, in his paper on Arctic Plants in the 'Transactions of the Linnean Society,' makes the *C. aleutica*, Bungard, and *C. Nutkaensis*, Trinius, to be the same as *strigosa* (recording it also as a Greenland plant, but it is unknown to the Danish botanists as such); if this is correct it will extend its distribution to Arctic, E. and W. America, and N.E. Asia.

When Dr. Smiles' 'Life of Robert Dick' appeared, I noted his record of finding the Lapland Rush, *Calamagrostis lapponica*, at Loch Duran. I wrote to Mr. Grant asking him to explore the Loch and send me specimens of the plant, as I suspected it could hardly be the true *lapponica* of Wahlenberg. Though the lake had been drained he found the plant, and forwarded me specimens, which were identified by Mr. N. E. Brown, of Kew, as *C. strigosa*, after comparison with specimens in Fries' Herbarium Normale, "though the ligule is not quite so acute as in the typical specimens." Specimens have since been submitted to Dr. Almquist, of Stockholm, who says they are very near the Norwegian examples.

It is one of the most interesting additions to the British flora ever made, as in combination with *Carex salina* and others it shows how close the affinity of the flora of the North of Scotland is with that of Scandinavia; and I venture to predict that there will be other Scandinavian species yet found, not only in Caithness, but in the Shetland Isles and in other parts of Scotland, especially north of the Caledonian Canal.

Scandinavia is very rich in the genus *Calamagrostis*, but the synonymy is much involved, and opinions differ as to whether some of the plants are hybrids or not. Anyone interested in changes in plant-names would find plenty of materials in this genus in the successive editions of Hartman's 'Handbook of the Scandinavian Flora,' from the 1st to the 11th.

Among *Characeæ*, the only new one I can report is *Nitella capitata*, Agardh, for Cambridgeshire. It is very near the common *N. opaca*, but the whole of the fruit is covered with a gelatinous substance, the ribs of the nucules are sharper, and the habits, &c., different. For this we are indebted to Mr. Alfred Fryer, of Chatteris, a gentleman who has explored the remains of the old fen ditches with great success.

It may well be asked: Why this constant stream the last few years of plants new to Britain? Were I called upon to answer this query I should say: Because Scotch plants in particular are now being studied in relation to the Scandinavian flora. There is no doubt that our English and Irish plants have been looked at from the Germanic and French floras, but it is different with Scotch Botany. As soon as we cross the border, and get to Dumfries and Kirkcudbright, we begin to get a sprinkling of forms that speak of another flora, until we get to Perth, Forfar, and Aberdeen, where a true Alpine (and even Arctic) flora is found. Further northward, in Caithness, we only want a more mountainous county to produce a very rich flora; but this is wanting in Caithness, its highest hill being Morvan (2340 ft.). Again, in the Orkney and Shetland Isles we have no great elevations such as occur in the Faroes, and this in combination with the more northerly situation is partly the reason they possess plants we do not, though I should not be surprised at a few of them eventually proving British.

In East Anglia the plants that have been found are simply the result of a study of the adjacent W. European coast-floras, and Norfolk and Suffolk are by no means exhausted; but it wants systematic search, such as a survey of the broads and rivers would produce. In Sweden this is being

done, but our government have refused a hydrographic survey of our English lakes.

Mr. W. H. Beeby read a paper, 'On some Recent Additions to the Surrey Flora,' as follows:—

On the last occasion that I had the pleasure of reading a paper before you I was able to record that during the year 1884 about ten species had been added to our Surrey list, these being either entirely new records or confirmations of old records made on very doubtful or insufficient authority. The result of the past season's work presents a considerable contrast to that of the previous one. Apart from critical forms and varieties there are no additions whatever to be recorded, and as the time given to investigation has been quite as great as in 1884, I think we may fairly conclude that our list is now a tolerably complete one, so far as the ordinary plants of the county are concerned; of course excepting critical forms and great rarities, a few of which may yet turn up in isolated localities. Still, notwithstanding the absence of any new species records, some interesting confirmations have resulted from the past year's work, as well as the rediscovery of one species which had become extinct in its original station.

The first plant to which I would draw attention is the Common Lady's Mantle, *Alchemilla vulgaris*. Though said to occur near Reigate, Dorking, and elsewhere, I have never been able to find it, and no Surrey specimens seem to exist in herbaria or have been seen by any botanist with whom I am acquainted. I was therefore very glad to receive a specimen last summer from Mr. Thomas Howse, who gathered it in a wood near Horsley, where it was first noticed by the Rev. George Sawyer.

One of our rarest plants, not only from a county point of view, but having regard to the whole of Britain, is the Slender Cotton-grass, *Eriophorum gracile*. Formerly known only in this country as a native of Yorkshire and Surrey, and occurring but in a single locality in each county, it has long been extinct in both. A few years since it was discovered in Hampshire, and last June I had the good fortune to meet

with it in some abundance in a *Sphagnum* bog near Aldershot. Unlike our other species of Cotton-grass, the present one does not grow actually on the peat, but apparently entirely among the *Sphagnum* and roots of bog-plants, at a distance of several feet above the soil. This peculiarity in its habit fully accounts for its disappearance on the approach of drainage. The others are not unfrequently seen in almost dry peat; but this is never the case with *gracile*, which is only to be found in the very wettest parts of the bog.

Among varieties new to Surrey I may mention a Mint which is supposed to be very rare, and indeed no locality was known for it until it was rediscovered in Norfolk a short time ago. It is *Mentha hircina*, and Mr. Baker considers it to be exactly the plant of Hull. It is usually placed as a variety of *M. pubescens*; but it so much more nearly resembles the Common Peppermint, *Mentha piperita*, under which species I should have placed it, that it seems more than probable that its supposed rarity is due to its having been passed over as the latter plant. It occurs in three stations in Surrey,—in a ditch at Dawes Green, near Reigate; near Holmwood Station; and near Chiddingfold,—and is a doubtful native in all three localities.

A good deal of misunderstanding has existed as to the different forms of *Epipactis* found in this country. This I believe to be partly due to want of opportunity to compare the different plants in a fresh state, herbarium specimens being mostly quite useless for this purpose. Though some attention was paid to these plants last year, I was unable to come to any satisfactory conclusion as to our Surrey forms, owing to the absence of *Epipactis media* of Fries. This plant appears to be very rare in Surrey, and I met with it for the first time last August not far from Witley. The discovery of this plant made it plain that, besides the Marsh Helleborine, we have three plants in Surrey, *viz.*, the more common Broad-leaved Helleborine, *Epipactis latifolia*; and also *E. media*, Fries; and *E. violacea*, Durand. Even the late Mr. Watson appears to have misunderstood these plants, and the only satisfactory description we have of them is that found in the 8th edition of Babington's 'Manual of British Botany.'

Special attention has been given this year to the Brambles, and, without going into detail, I may say that of the twenty-four subspecies into which Mr. Baker divides the fruticose *Rubi*, twenty-two are represented in Surrey by one or more of their forms. Probably two of Brewer's species will have to be cut out as errors, but, on the other hand, a dozen or more new forms have to be added. Owing to the valuable assistance of Mr. Baker, both in examining plants submitted to him and in himself studying the Surrey forms out of doors, the account of this most difficult group bids fair to be a most satisfactory one.

I may mention a new station for the Great Hairy Woodrush, *Luzula sylvatica*, previously only known from one locality. It occurs abundantly in a dry wood by Leigh Millpond, near Godstone.

The last plant I have to speak of is the Common Buttercup, *Ranunculus acris*. The varieties *Steveni* and *vulgatum*, the a. and b. of Symes' 'English Botany,' together constitute the common plant of the county. These two varieties, however, do not seem to be always readily separable, and not unfrequently present intermediate characters. They are both characterised by a creeping rootstock. But, besides these, we have a very distinct form which will perhaps eventually be conceded subspecific rank. I allude to *Ranunculus Boræanus* of Jordan. This has been looked for in Surrey, but, as far as I know, has not been met with until this year, when I found it by the Thames-side near Runnymede, and also near Byfleet. It is distinguished from the last chiefly by its rootstock being vertical, instead of creeping.

In conclusion, I may say that I fully expect that next year's work will suffice for the completion of the necessary outdoor work in connection with the Surrey Flora. A few only of the twelve districts require working, both as regards some critical and some common plants, and this I hope to complete in the course of next summer.

Mr. Albert J. Crosfield exhibited specimens of the following plants obtained by him in Wensleydale during the past summer:—

<i>Rubus Chamæmorus</i> (in fruit).	<i>Carduus heterophyllus</i> .
<i>R. saxatilis</i> .	<i>Crepis paludosa</i> .
<i>Rosa mollissima</i> .	<i>Hieracium prenanthoides</i> .
<i>Sedum villosum</i> .	<i>H. crocatum</i> .
<i>Ribes alpinum</i> .	<i>H. amplexicaule</i> .
<i>Saxifraga sponhemica</i> .	<i>Vaccinium Oxycoccus</i> .
<i>Myrrhis odorata</i> .	<i>Melampyrum pratense</i> , var.
<i>Galium palustre</i> , var. <i>Witheringii</i> .	<i>ericetorum</i> .
<i>G. sylvestre</i> .	<i>Habenaria albida</i> .
	<i>Calamagrostis epigeios</i> .

Dr. Bossey remarked that there are three series of rare British plants:—(1) Parasites, dependent on other plants; (2) the last representatives of a flora that is dying out, mostly Arctic; (3) new introductions, mostly Germanic.

R U L E S .

NAME.

I.—The Association shall be styled “THE HOLMESDALE NATURAL HISTORY CLUB.”

OBJECTS.

II.—The investigation of the Natural History of Reigate and its vicinity, and the mutual improvement of the members in the study of Nature.

CONSTITUTION.

III.—The Club shall consist of Members, Subscribers, Corresponding Members, and Honorary Members.

MEMBERS.

IV.—Members shall be elected by ballot or show of hands at any Ordinary Meeting. The candidate to be recommended by one or more Members at any Ordinary Meeting, and the election to take place at the Meeting next ensuing.

SUBSCRIBERS.

V.—Subscribers shall be elected in the same manner as Members, and shall have all the privileges of Members, except of holding any office in the Club, or of voting upon any matter connected therewith, or of having any right or ownership in the property of the Club.

CORRESPONDING MEMBERS.

VI.—It shall be competent for the Club to elect as Corresponding Members any gentlemen distinguished for their attainments in Natural History, either as collectors or authors, or to whom the Club may be indebted for contributions of papers or specimens; such Corresponding Members to have similar privileges to Subscribers without payment, and to be elected by the Club upon the nomination of the Committee.

HONORARY MEMBERS.

VII.—Honorary Members shall be elected by the Club upon the nomination of the Committee; and shall be exempted from the payment of subscriptions, and shall have the privileges of Subscribers.

OFFICERS.

VIII.—The Club shall, at the Annual General Meeting, elect from among themselves a President, Treasurer, Secretary, Curator, and nine Members to form a Committee of Management, three of whom to form a quorum.

VICE-PRESIDENTS.

IX.—The President shall nominate annually two Vice-Presidents from the members of the Committee.

ANNUAL GENERAL MEETING.

X.—This shall be held previous to the Evening Meeting on the third Friday in October, when the Committee shall present a Report detailing the general state, proceedings, and pecuniary condition of the Club, and proceed to the election of officers.

SPECIAL MEETINGS.

XI.—The Committee shall have the power to call a Special General Meeting at any time, and they shall do so within four weeks after receiving requisition to that effect, signed by at least five members. The notice calling the Meeting shall state the objects for which the Meeting is called, and no other business shall be transacted.

ORDINARY MEETINGS.

XII.—These shall be held on the third Friday in every month, from October to April inclusive, or more frequently at the option of the Committee.

SUBSCRIPTIONS.

XIII.—Each Member shall pay to the Treasurer Ten Shillings on his election, and the same sum at the Annual General Meeting each year; but may compound for such Annual Subscription by payment of Five Pounds. Each Subscriber shall pay to the Treasurer Five Shillings on his election, and the same sum at the Annual General Meeting each year. That it shall be optional with the Committee to strike out the name of any Member or Subscriber who shall be in arrear with his Subscription for twelve months or more.

NEW RULES.

XIV.—Any five Members wishing to propose a New Rule, or the omission or alteration of any existing Rule, must send notice to the Secretary, who shall within a month call a Special General Meeting to consider the change proposed.

LIBRARY AND COLLECTIONS.

XV.—The Club shall form, as opportunity may offer, a Library of Reference, consisting of works bearing on the subject of Natural History; and obtain Collections of the natural objects of the neighbourhood. The Library, Collections, and Funds to be the property of the Members for the time being, and shall be vested in Trustees for the use of the Members. Contributions of Life Members shall also be invested in the names of such Trustees in such manner as the Committee may direct, the interest arising therefrom to be handed to the Treasurer for the general purposes of the Club.

ELECTION OF TRUSTEES.

XVI.—The Trustees shall consist of the President for the time being, and three other Members to be elected by the Club.

LIST OF MEMBERS AND SUBSCRIBERS.

*Names marked * are Honorary Members.*

Names marked † are Subscribers.

- †ASHBY, EDWIN; Oakland, Redhill.
ASPLAND, THEOPHILUS L.; Deepdale, Reigate.
ASPLAND, MRS. T. L.; do.
BAKER, C. E.; Effingham Road, Reigate.
BARNES, P. A.; Redhill Common, Redhill.
BAXTER, ROBERT C.; Hethersett, Reigate.
†BEEBY, W. H.; 14, Ridinghouse Street, London, W.
†BEEBY, Miss E. M.; St. Albans Lodge, Reigate.
†BONNOR, JAMES; Linkfield Lane, Redhill.
BOSSEY, FRANCIS, M.D.; Mayfield, Redhill.
†BRASS, Rev. HENRY, M.A.; Redhill.
BROOKS, WILLIAM; Laurel Villa, Reigate.
*BROWN, N. E.; Herbarium, Kew.
CAREY, FREDERICK GEORGE; Southbank, Redhill.
†CAZENOVE, Rev. Canon, M.A.; St. Mark's Vicarage, Reigate.
†COOMARA-SWAMY, Lady; St. Alban's Lodge, Reigate.
COOPER, THOMAS; Brighton Road, Redhill.
CROSFIELD, JAMES B.; The Dingle, Reigate.
CROSFIELD, HERBERT; do.
CROSFIELD, Miss; do.
CROSFIELD, ALBERT J.; Carr End, Reigate.
CROSFIELD, Mrs. A. J.; do.
CUDWORTH, JAMES I.; Woodcote, Reigate.
CUDWORTH, Mrs. J. I.; do.
†DAVIS, J. R. AINSWORTH, B.A.; University College, Aberystwyth.
DUNCAN, WILLIAM A.; Woodlands Road, Redhill.
*EVELYN, W. J., M.P.; Wotton House, Dorking.
FERNELEY, CHARLES A.; High Street, Reigate.
†FIELD, J. LOUIS; Brooklands, Redhill.
GABELL, ALVERSTONE, L.D.S.; Station Road, Redhill.
GILBERT-WILLIAMS, HORACE W.; 26, Portland Street, Aberystwyth,
South Wales.
GILFORD, WILLIAM; Beech Grove, Redhill.
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HEAD, ARTHUR J.; Meadvale, Redhill.
HEATON, WILLIAM H.; St. David's, Beckenham.
HESKETH, R. L.; Ringley Mead, Reigate.

- HOLMAN, CONSTANTINE, M.D., J.P.; The Barons, Reigate.
 HOLMAN, Mrs. C.; do.
 †HOOPER, T. R.; Redhill.
 HORNE, EDWARD, J.P.; Park House, Reigate.
 †KENSIT, G. H.; Hazel Cottage, Lesbourne Road, Reigate.
 KERSTING, ARTHUR; Clarendon Road, Redhill.
 KERSTING, WILLIAM; Clarendon Road, Redhill.
 LAINSON, HENRY, J.P.; Colley Manor, Reigate.
 LEES, JOHN; Reigate.
 LENTHALL, CHARLES H.; Reigate Hill.
 LINNELL, JOHN; Redstone Wood, Redhill.
 LUBBOCK, Sir JOHN, Bt., M.P.; 15, Lombard Street, London, E.C.
 †MARRIAGE, THOMAS SYDNEY; Bell Street, Reigate.
 †MARTIN, Miss; Oxford Road, Redhill.
 MENZIES, Rev. JAMES; Redhill.
 MILNER, E. A.; West Street, Reigate.
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 NEWMAN, Mrs. T. P.; do.
 †NICHOLSON, JAMES; Salmon's Cross, Reigate.
 NOAKES, RICHARD; Bridge Road, Redhill.
 PAINE, W. DUNKLEY; Cockshot Hill, Reigate.
 †PAWLE, FREDERICK C., J.P.; Northcote, Reigate.
 †POULTER, DANIEL P.; Gloucester Road, Redhill.
 ROSLING, HENRY; Alders Road, Reigate.
 SILLITOE, F. S.; Station Road, Redhill.
 SKINNER, J.; Hardwicke Villas, Reigate.
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 †STERRY, Miss ELEANOR S.; do.
 †STERRY, Miss IDA S.; do.
 †STERRY, JOHN; Earlswood Road, Redhill.
 †STERRY, Mrs. J.; do.
 †TINDALL, ERNEST E. P.; Ranelagh Road, Redhill.
 TYNDALL, WILLIAM H.; Morlands, Redhill.
 TYNDALL, Mrs. W. H.; do.
 URQUHART, C. F.; Fernside, Reigate.
 VAUGHAN, HOWARD; 55, Lincoln's Inn Fields, London, W.C.
 WALDUCK, CHARLES E.; Lee, S.E.
 †WALTERS, JOHN, M.B., J.P.; Church Street, Reigate.
 *WATNEY, DANIEL; 62, Old Broad Street, London, E.C.
 WEBB, HENRY; Redstone Manor, Redhill.
 *WEBB, SYDNEY; Maidstone House, Dover.
 WHEELER, W. H., M.D.; Roseneath, Reigate.





PROCEEDINGS

OF THE

HOLMESDALE NATURAL HISTORY CLUB

FOR THE YEARS 1886 AND 1887.

TOGETHER WITH

RULES AND LIST OF MEMBERS.



LONDON:

PRINTED BY WEST, NEWMAN & Co., 54, HATTON GARDEN, E.C.

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Honorary Secretary:

ALBERT J. CROSFIELD, *Carr End, Reigate.*

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PROCEEDINGS
OF THE
HOLMESDALE NATURAL HISTORY CLUB.

EVENING MEETING.—JANUARY 15TH, 1886.

Dr. Bossey exhibited a pear of abnormal growth which, he remarked, favoured the idea that the pulpy fruit was a development of the fruit-stalk or axis. The rind of the pear showed traces of successive developments of the five segments of the calyx, which appeared to have been reproduced five or six times.

A paper by Mr. Edward Horsnail, of Dover, was read, on 'THE MARINE AQUARIUM, ITS HISTORY AND MANAGEMENT,' from which the following extracts are taken :—

Having been for many years a keeper of Marine Animals in Aquaria on a small scale, with, I think I may say, at least an average measure of success, I propose, in the present paper, to offer a few simple hints which may possibly be of service to any of our members who may wish to commence this most fascinating pursuit.

After tracing the history of Marine Aquaria, Mr. Horsnail says :—

I will now proceed to the more especial subject of this paper, *viz.*, the construction and management of aquaria in private houses. An aquarium may be established in any vessel which will hold water without contaminating it.

The best form undoubtedly is a rectangular vessel, constructed with slate bottom and ends, and plate-glass sides; always provided that it is properly put together and absolutely water-tight. The size of such a tank must be regulated

by the space available, and other circumstances; always bearing in mind that the dimensions should be extended in area rather than in depth, a broad, shallow tank being infinitely superior to a narrow and deep one. A depth of twelve inches is amply sufficient for all practical purposes, and has the advantage of being much more readily accessible than one of greater depth.

Having provided our aquarium the next business will be to stock it; but first I must say a few words as to its position. This is often more a matter of necessity than of choice: a north or north-east aspect is undoubtedly the best, and such should be chosen wherever practicable. If the only available window face the south or west, much care will be required to protect the aquarium from the direct rays of the sun during the summer and early autumn. In fact, to keep it in health at all in a south aspect during the heat of summer is a very difficult matter indeed.

The position being decided upon, the next thing will be to procure some fine shingle,—the finer the better,—sufficient to cover the bottom of the aquarium to a depth of a couple of inches. This must be well washed until the water runs away perfectly clear, and then placed in a sieve to drain. Some sort of rock-work is generally desirable. This should be as natural as possible; fragments of rough granite or ragstone answer well: tufa I have used largely, but am disposed to condemn it, as it is very brittle and apt to make the water thick if disturbed. It has, however, the advantages of being very light, and holding a good deal of water.

In a tank a good plan is to build up the rock-work with Portland cement at each end, either fixed to the slate, or, what is better, in two loose masses, sufficiently strong to bear removal. If cement is used, the rock-work must be soaked in fresh water for two or three weeks to remove the free lime and carbonic acid, or it will poison everything. Having arranged our rock-work and gravel, the next thing required will be the water. This should be obtained a couple of days before it is wanted. It should be dipped from the sea as the tide is flowing, and placed in earthenware vessels

to settle. In forty-eight hours it will be brilliantly clear, and may be carefully drawn off with a syphon, so as not to disturb the sediment.

No growing seaweeds should be placed in the tank, and, after the water has been added, the whole should be left for a week or more before any animals are put in. By this time or longer, according to the aspect and time of year, the spores of *conferva* will be beginning to strike root, and animal life may be gradually introduced. No exact directions on this head can be given; everything must depend on the dimensions of the aquarium, the temperature, and the class of creatures it is desired to keep. As a rule, the lower organisms will be found easier to keep than the higher, and will require a smaller amount of oxygen to support them in health. Several anemones may be kept in a vessel which will only bear one or two fish. Do not put in too many things at a time; let one specimen get thoroughly settled before adding another, always bearing in mind that the first few days in confinement are the most trying to your animals, especially fishes. If they survive the first week they are likely to survive the second, and then still more likely to survive the third, and so on; always supposing that they can be provided with their proper food, and that their habits of life are such as to render them fit subjects for aquarium study.

The temperature should be kept as uniform as possible, though this in summer time is a rather difficult matter. I have found it a good plan to have a large earthen crock, a grape-jar or similar vessel, capable of holding several gallons of water. This is kept in a cool cellar, and every evening, or oftener during sultry weather, a portion of the water can be drawn off from the aquarium and replaced with cool water from the reserve, to which the heated water from the tank can then be transferred to be cooled in its turn. Never, if you can avoid it, throw away water which has become acclimatized in your aquaria. Old water is far preferable to new, and, if it should become too dense by evaporation, it is easy to reduce it by adding a little rain-water, though I do

not think the exact specific gravity is of so much importance as it is often thought to be, so long as it is near the mark.

If you want to stock a fresh tank or bell-glass the best way is to draw a portion of the water required from each of the old ones, and then fill up each with some of the fresh supply. This will assimilate your whole stock, and a partial transfer of water from vessel to vessel is often of advantage. Above all, the most scrupulous cleanliness must be observed in everything connected with your tanks and glasses. Let the water be perfectly clear and free from organic impurity, the beach and rock-work the same, and never, if you can avoid it, introduce your hand, however clean. To do so may now and then be necessary, but one or two simple instruments will generally obviate the need. A small net on a ring of cane or wire, a slender stick for feeding (a boxwood knitting-pin answers well), and a little wooden shovel fixed in a long handle are the most useful implements. A glass syringe is also a very valuable addition, especially in warm weather; a good syringing will aerate the water, and seems to revive the flagging energies of the animals. Many of them appear to thoroughly enjoy it; probably it answers the same end as the beating of the surf on the shore, in mixing a quantity of atmospheric air with the water. Any animal which may happen to die should be removed at once; and, should the water be contaminated, it should be withdrawn by means of a syphon, and its place supplied from the reserve. The foul water, if placed in a cool, dark place for a few days, will again be found perfectly clear and sweet.

When an aquarium is thoroughly established, with a good growth of *conferva* and a healthy stock of animals, it is best to let well alone, and not to aim at too great results.

Judicious additions may be made to the stock as occasion serves, but it should always be borne in mind that it is far better for your tank to be under than overstocked.

After giving some hints as to the animals most suitable to be kept, Mr. Horsnail added:—

The temperature should never be allowed to fall much below 50° Fahr., and the less it rises above 65° the better;

this is an almost impossible limit in hot weather, and a few casualties are then unavoidable. Spring and autumn are the best seasons to commence, though I should give the preference to autumn, as it is much easier to keep specimens through the winter than the summer, and, moreover, most animals are more readily obtained. About August and September the sea swarms with life of all sorts, and many species which are at other seasons difficult to obtain may be captured between tide-marks.

In the course of the discussion which followed Mr. Brooks remarked that in Cornwall poachers frequently use crabs instead of ferrets, sending them down the rabbit-holes, with short pieces of lighted candle on their backs, to drive the rabbits out.

Mr. W. H. Tyndall read a paper as follows :—

METEOROLOGY, OXFORD ROAD, REDHILL, 1885.

The Meteorology of 1885 does not present any marked features beyond the unusual drought of July and August.

The number of days on which rain fell in July was only four, amounting altogether to less than $\frac{1}{4}$ in., 0·24, whereas the average number of days on which rain fell in July during the last 19 years was 13·2, and the average amount 2·53 in.

In August the number of days on which rain fell was 11, and the total quantity 0·99 in., the average number of days during the last 19 years for August being 14, and the average quantity for the month 2·50 in.

No rain fell for 12 days from June 25th to July 6th; and again none for 7 days from the 12th to 18th of July; and for 16 days from July 20th to August 4th.

September, October, and November compensated for the drought of July and August. May, which is usually a dry month, had 3·46 in. of rain to its credit.

There were four heavy falls of rain :—

On Sept. 7th, 1·01 in.	Oct. 23rd, 1·08 in.
„ 10th, 1·37 in.	Nov. 18th, 0·97 in.

METEOROLOGY. — OXFORD ROAD, REDHILL, SURREY (1885).

Month.	BAROMETER.				THERMOMETER.								RAIN.	
	Max.	Date.	Min.	Date.	Max.	Date.	Min.	Date.	Average.		Mean.	Total of Month.	No. of Days -01 fell.	
									Max.	Min.				
Jan. .	30·35	7	28·98	11	50·0	29	23·0	20	39·73	32·08	35·90	2·60	16	
Feb. .	30·14	12	29·20	1	54·5	12	25·5	20	47·77	36·20	41·98	3·41	21	
March	30·52	14	29·24	6	54·0	31	24·0	7	46·86	31·50	39·19	1·83	12	
April.	30·31	18 & 19	29·27	6	69·0	20	28·0	4	55·40	38·07	46·73	1·69	14	
May. .	30·17	12	29·20	22	69·0	28	30·0	7	57·66	40·57	49·11	3·46	19	
June .	30·41	11	29·60	20	80·0	24	39·5	10	68·38	48·68	58·53	1·76	10	
July .	30·46	22	29·94	19, 20	86·5	26	43·0	23	73·95	51·57	62·76	0·24	4	
Aug. .	30·37	14	29·75	10	78·0	17	40·0	13	68·00	48·57	58·28	0·99	11	
Sept. .	30·37	22	29·46	11	70·0	3	31·0	26	62·20	46·00	53·96	5·00	24	
Oct. .	30·20	17	28·96	10	59·0	2	32·0	25, 29	51·61	39·08	45·35	4·42	20	
Nov. .	30·34	16	29·40	25, 28	56·0	30	28·0	17	47·25	37·67	42·46	3·40	18	
Dec. .	30·51	24	29·48	6	49·0	3, 4, 17	20·0	11	41·77	32·56	37·07	1·53	11	
Year.	30·52		28·96		86·5		20·0				47·61	30·33	180	

(The heaviest continuous fall recorded by me was on May 14th and 15th, 1875, when 2·45 in. fell).

Only four other falls during the year exceeded $\frac{1}{2}$ in., and these occurred in February, March, June, and December.

Taking the heaviest falls in each month the 12 days above mentioned produced 9·17 in., or nearly one-third of the total fall of the year, leaving only 21·16 in. for the remaining 168 days on which rain fell.

The total fall of the year was less by under an inch than the average as recorded by me during the past 19 years, such average being 31·18 in. against 30·33 in. in 1885. In the London district 24·45 in. fell on 158 days.

But little snow fell during the year. There were slight falls on Jan. 12th, 13th, and 14th, amounting together to 0·26 in. of rain; and again, on March 21st and 22nd, was a heavier fall equal to about 0·77 in. of rain. . . .

Hail fell on Jan. 31st, accompanied with a heavy gale with lightning and thunder. This district is not subject to heavy electrical storms.

The total number of days on which rain or snow fell was 180, a little over the average. The average number of days on which rain falls at Redhill in a year, according to the experience of the last 19 years, is 178·7 days. The least number of days was in 1868, 157 days; the greatest number in 1872, 215 days; the range being 58 days. The wettest year in the period of 19 years was 1877, when 39·07 in. fell; the driest year was 1870, when only 23·73 in. fell; giving a range of 15·34 in. The average for the whole period of 19 years was 31·18 in. The wettest month was October, 1880, when 7·48 in. fell; the next wettest December, 1876, when 7·24 in. fell; the driest month was July, 1885, when only 0·24 in. fell; the next driest being June, 1870, when 0·33 in. fell.

The order of the amount of rainfall in the several months is as follows:—

REDHILL.			GREENWICH.		
		Average.			Average.
October ...	...	3·44 in.	October ...	...	2·94 in.
January ...	...	3·41 „	August ...	...	2·69 „
September ...	...	3·29 „	July ..	...	2·63 „
November ...	...	3·01 „	June ...	...	2·48 „
December ...	...	2·96 „	September ...	...	2·43 „
July ...	...	2·53 „	November ...	...	2·38 „
August ...	...	2·50 „	January ...	...	2·14 „
February ...	...	2·46 „	April ...	...	2·12 „
June ...	...	2·15 „	December ...	...	2·07 „
April ...	...	2·07 „	May ...	...	1·78 „
May ...	...	1·90 „	February ...	...	1·61 „
March ...	...	1·81 „	March... ..	...	1·24 „
<hr/>			<hr/>		
31·53 „			26·51 „		

It will be seen that it is only during the wettest and driest months of the year that Greenwich corresponds with Redhill.

From April 18th to 21st, 1885, the sky was, so far as my observation extended, quite cloudless, and again from May 31st to June 4th.

In regard to the barometer, there occurred an unusually rapid fall on Jan. 9th. It fell from 29·77 in. to 29·12 in. in less than 12 hours, and in 12 hours more it had risen again to 29·53 in. This rapid variation was the more remarkable as it was unaccompanied with high wind, nor was there a heavy fall of rain.

The barometer was over 30 in. for 180 days, over 29 in. for 183 days, and fell below 29 in. on two occasions only, Jan. 11th and Oct. 10th.

The thermometer had an extreme range of 66·5°, the lowest being 20° on Dec. 11th, and the highest 86·50° on July 26th. I have recorded, since my residence at Redhill, an extreme range of over 90°.

The thermometer reached 80° and upwards on 5 days; 70° and upwards on 43 days; and sank to 32° and under on 79 days. The thermometer fell to freezing-point and under—

19 days in March.	4 days in April.
17 „ January.	3 „ May.
17 „ December.	2 „ October.
9 „ February.	1 „ September.
7 „ November.	

The drought of July and August would doubtless have yielded a higher temperature than it did had not the winds during that period been westerly and northerly; the sky, too, was not so clear as it would probably have been with an easterly or southerly wind. . . .

Comparing the temperature of Redhill with that recorded for the London district by the Meteorological Office, the temperature at Redhill was in every month lower. The average of the year, as recorded by that office, was 49.3° ; by me 47.6° . Oxford Road, Redhill, is about 300 ft. above sea-level.

The coldest day recorded by me during the 19 years was Jan. 4th, 1867, when the thermometer sank to 0.5° above zero, Fahr. The next coldest day was Jan. 3rd, 1867, when the thermometer fell to 1° . The hottest day was on July 5th, 1881, when the thermometer rose to over 90° . At Tottenham, in January, 1838, I registered 0.4° , and on June 16th, 1858, 94.5° , showing a range of 98.5° .

In regard to wind, the whole year has been unusually free from violent storms, though some have visited our western coasts.

There was a heavy gale on Jan. 31st, and renewed for a short time on Feb. 2nd. A gale blew on Feb. 6th and 8th, and in the morning of April 24th. March appears to have escaped.

No strong winds recurred after April till Nov. 27th and 28th, when it blew very hard on the night of the 27th and morning of the 28th.

The drought of July and August was prejudicial to the root-crops and the grass, but wheat, which strikes its roots deep down into the earth, did not suffer, and the crops of corn were for the most part good.

EVENING MEETING.—FEBRUARY 19TH, 1886.

Mr. A. J. Crosfield exhibited an ornamented Roman tile, forming a section of a hot-air pipe, which was dug up in Mr. Pym's field on Doods Farm.

The following letter from Mr. W. H. Beeby was read:—

"On the occurrence of *Equisetum litorale* (Kühlewein) in Britain."

"When botanising on Bisley Common, near Pirbright, last June, I found an *Equisetum* which seemed to differ from all described British species. Subsequent examination proved that this impression was correct, and that it was truly distinct. The plant was accordingly sent for examination to Professor Lange, of Copenhagen, who pronounced it to be the above species. Although not a common plant, it has a wide range on the Continent, and is therefore likely to be found sparingly elsewhere in this country. The discovery of a new British species in a county usually considered to have been so well-worked as that of Surrey is of special interest. The plant is recorded in the 'Journal of Botany' for this month, and will be figured when fresh specimens can be obtained."—W. H. BEEBY, Feb. 16th, 1886.

Dr. Bossey exhibited plates illustrative of "POND-LIFE," and described several animalcules.

Melicerta, the brick-maker, he has frequently found in the ditches and mill-pond at Ham Farm on American weed. The *Melicerta* collects floating-matter on a flat disc and sorts it, rejecting what is useless, masticating part, and with its ciliæ rolling up other substances into bricks, which it makes in about three minutes, in a small bag. With the bricks it encases itself in a house.

Stephanoceros is to be found in Gatton Park. It makes a bag like a miller's sack with the mouth inverted, and has fixed arms and ciliæ. The sack is gelatinous.

Floscularia ornata produces eggs of two kinds; one kind develop rapidly during summer; the others live through the winter.

Dr. Bossey exhibited, under the microscope, Wheel Animalcules, *Stentor* and *Vorticella*, obtained on American weed in the Little Moat. *Vorticella* are perfectly transparent, and are very common.

Dr. Bossey remarked that a rotifer has been known to revive after being dry for years. For breeding purposes obscure light is the best; bright sunlight often kills them. Some prefer impure water, some ponds, others running water.

Mr. W. H. Tyndall introduced the question of "THE ORIGIN OF HILLOCKS ON THE SURFACE OF OUR COMMONS."

Discussion followed, when several opinions were brought forward.

Further investigation led to the discovery of Ants of a light brown colour at a depth of about 8 in. below the surface of some of these mounds on Earlswood Common.

Mr. James B. Crosfield made some remarks upon "THE WINTER HABITS OF BIRDS."

The chief pursuit of birds during the short days of winter is the search for food, and in times of frost and snow some birds are worse off than others. Ground-feeding birds are worst off, as the supply of worms and slugs is not obtainable when the ground is hard.

The food-supply affects migration, and most species are found to be partially migratory. The Water Wagtail, for instance, leaves the northern counties of England during winter. Starlings, Thrushes, and Wood Pigeons seem to be increased in numbers in winter. Larks, Finches, Sparrows, and Linnets feed in flocks in winter. Perhaps no birds suffer more in severe weather than Thrushes and Blackbirds do, berries, worms and slugs being their chief food. Rooks also suffer greatly.

On the other hand, the Tits and Goldcrests hardly seem to feel the cold. They find their food amongst the twigs of pines and firs, where it is accessible in hard weather. The Nuthatch and Creeper scarcely change their habits at all on account of stress of weather.

We may summarise the question by saying that food is the governing cause of the winter habits of birds.

Mr. J. B. Crosfield mentioned that three Siskins had during the past fortnight been frequenting his garden, feeding under a *Cupressus*.

Mrs. Tyndall said she had seen Siskins lately in her garden at Redhill.

EVENING MEETING.—MARCH 19TH, 1886.

The attendance of young persons was specially invited, and about ninety in all were present.

The following paper was read by Mr. Horace W. Gilbert, on 'HOW AND WHY ANIMALS DIFFER.' Part II., Vertebrates:—

When I had the pleasure last year of giving you an address on the subject of the Animal Kingdom I treated of the Sub-kingdom, "Invertebrata," or animals without a back-bone; and I endeavoured on that occasion to give you an idea of the main differences by which the several groups are distinguished from one another, paying special attention to the senses which enable them to find their food, and to the organs of locomotion and alimentation by means of which they managed to obtain and digest it. In fact I regarded them as "eaters," in contradistinction to the members of the Vegetable Kingdom, which we may call "absorbers."

On the present occasion I shall consider the subject of the Sub-kingdom "Vertebrata," or back-boned animals, and we shall find that some of the organs enabling them to obtain and digest their food form equally good distinguishing features of the groups into which they are divided; and I shall pay special attention to the limbs, for we may say that power of locomotion to a back-boned animal means existence itself, unlike some of the invertebrates, as the oyster and coral, and others which are confined to one spot all their lives and have their food brought within their reach by the water. For most of the vertebrates are comparatively of large size, and require a considerable range of water or land to furnish them with their requisite quantity of food, whether they be carnivorous

and preying on other animals, or herbivorous, feeding on plants.

The Vertebrates, then, differ from the Invertebrates in possessing a long column, generally jointed and bony, extending from their head to the end of their tail, and forming a firm support for the attachment of the head and limbs, and all other parts of the body.

The simplest form of vertebrate with which we are acquainted is the fish, the Lancelet. This little creature, which is almost transparent, burrows in sand at the bottom of shallow water. The back-bone, or what passes for such, is a continuous cartilaginous or gristly rod, called the "notochord," running from one end of the creature to the other; and there is nothing which answers to either ribs, skull, or limbs. It has a large oval mouth, fringed with tentacles leading into a large throat or pharynx, which is covered on the inside surface with vibrating "cilia." This large throat leads into another chamber, and this again into an intestine along which the food passes. Now, on each side of the pharynx there is a row of slits, and as the water is wafted into the pharynx from the mouth by the waving cilia it passes out through these slits into the cavity of the body, and then out again by a small opening; this represents the breathing-apparatus for purifying the blood. The heart is a very simple affair, a mere tube which keeps on expanding and contracting, and so drives the white blood along the vessels which are in connection with it. Some of these vessels pass up the divisions between the slits, and so bring the blood into near contact with the water which passes through them; this is a very simple form of gill. The spinal marrow or cord is only represented by a thread of nerve lying along the upper side of the notochord; and this is quite simple, not enlarging into anything like a brain at the head-end, but giving off small nerves to the mouth and to the tiny imperfect eyes. In this simply-made animal we see that a few, and a very few, of the characters of the Vertebrates have their representatives.

There is another small animal classed with this Lancelet in the lowest division of Vertebrates, and to show that it is

by no means possible to draw a hard-and-fast line between the Vertebrates and the Invertebrates, this creature has until quite recently been classed with the Tunicates, which were at one time regarded as a division of the Mollusca, or shell-fish, though these are without shells proper, but are provided with a tough, leathery kind of covering, a cloak or tunic, whence their name (Tunica—a cloak). And it is indeed difficult to say whether both should not be put back out of the back-boned division, as they differ so strongly from all other Vertebrates.

In the next division, the “*Marsipobranchii*,” to which the Lampreys belong, there is a distinct skull at the end of the notochord, and this contains a small brain, that is, a knob of nerve which is divided into certain definite parts. The heart is an ordinary fish's heart of two chambers, one, the auricle, —which receives the blood from the body, and the other, the ventricle, a pump which forces it through the body again and so keeps it circulating. The breathing-apparatus, or gills, consists of a tube leading from the mouth and passing through pouches opening by seven holes on each side of the neck, and out of these the water pours, passing on its way the blood-vessels which line the skin of these pouches. These fishes feed on other fish, such as the cod. One kind, called the Hag, gets into the gills of the fish, and literally eats itself out of house and home, unless we choose to regard the skin and bones as its roof and rafters, for these are all that is left of its unfortunate host. In the Lamprey there are no indications of limbs, and no jaws; but they have a round mouth fringed with tentacles, and well studded on the inside with horny teeth, with which they rasp away the flesh of their prey.

The next division includes the Sharks and Rays, and among these we meet for the first time with a regular jointed backbone, though others of the same division have got no farther than the notochord stage. In the Rays the spinal column is a very good, bony one, and their skin is covered by a mass of scattered, bony points, rendering it a hard matter to cut through it; and when these points are set closely together their skin is known as shagreen, and is or used to be made

into a variety of ornamental articles. These resemble teeth in their structure, and in point of fact are teeth in all but their function. The skull of the Elasmobranchs is gristly or cartilaginous, and when jaws are represented they consist of the same substance. The Sharks are well supplied with sharp teeth, however. In this division we get fins which represent parts of the fore and hind limbs of the higher animals, in the the pectoral and ventral fins. There is something noticeable about the caudal fin or tail. The spinal column turns rather upwards at the end, and that part of the tail-fin attached above it is smaller than that part below, giving the fin an unequal appearance. This is seen in our small English Shark—the Dog-fish. In some of the Rays there is a poisonous spine attached to the tail. The Elasmobranch-gills consist of flattened sacs or pouches in the side of the neck, through which the water flows, which is taken in at the mouth, and, passing on its way the blood-vessels which line the walls of these pouches, goes out by a row of slits. The eggs of this division are interesting. They are very large, unlike those of our common edible fishes, and contain the young fish enclosed in his leathery or rather parchment-like case. The popular names given to fishes of this group show great variety, for among them we get Devil-fish, an immense Ray; Angel-fish. The Torpedo, too, a term which has grown so familiar to us in connection with another object as to make us almost forget that it originally belonged to an electric fish.

The Ganoid division is so named from the peculiarity of their scales, which consist of bone covered with enamel. In some of these the scales overlapped one another like tiles on a roof, but in others they were large, bony plates fitted edge to edge, or arranged at intervals on the skin. We have but few of these Ganoids now living, and these are almost all found in rivers and fresh-water lakes. The Sturgeon is a good example, found in the rivers of Russia, where it is one of the scavengers of the waters, moving along the bottom, and devouring any decaying substances it may meet with. One species of Sturgeon is sometimes taken in the sea off the English coast. By far the most numerous

forms of the Ganoid division are found deep down in the earth, as fossils. They occur in layers of limestone and sandstone which once formed as mud and sand at the bottom of large fresh-water lakes, like the great lakes of America, and which covered sites now occupied by the British Islands. Strange to say, some of the modern forms of these armoured Ganoids are now found in the American lakes. The Ganoids possess ordinary gills with which to breathe, that is, the long pouches or tubes through which the water flowed in the Lancelet, Lamprey, and Shark, and which sufficed to bring the air dissolved in the water into contact with the blood-vessels surrounding those tubes, have for the most part disappeared, and we get what is known as the branchial or breathing-tufts more fully exposed, though they are now protected from outward injury by covers or opercula, and present the ordinary form of fish-gills.

The next order is a very large one, and embraces a great variety of forms. There is one characteristic, however, runs strongly throughout the group, and as most of our edible fishes belong to this group, we become fully sensible of this feature while eating them. I allude to their bony skeleton, which gives the name of Teleostei, or perfect bones, to the order. Among the large number of these fish I will mention the Perch, with the Indian Perch which climbs up trees, Pike, Salmon, Eel, and Electric Eel among fresh-water fish; and the Cod, Herring, and Mackerel among marine fishes.

One subdivision of the Teleosteans contains some curious little fishes, the Sea Horses and Pipe-fishes; the male Pipe-fish has a pocket in which he carries the eggs about until they hatch. Another subdivision contains the extraordinary Globe-fish, or Sea Porcupine, of which I show a specimen, and the common Sun-fish, which sometimes attains the weight of half-a-ton or so. Both these fish have the power of distending themselves with air and floating half out of the water. The pectoral-fin contains four small bones, to which the fin-rays are attached, and these are considered by some naturalists to represent the humerus or shoulder-bone.

The last and highest group of fishes is the Dipnoi, a word meaning "two breathings," in allusion to the fact that they have acquired lungs to breathe with in addition to their gills, their lungs being derived from the air-bladder of ordinary lower fish. The heart, too, is an advance upon that of other fish, for it contains an extra chamber, called the left auricle, into which the blood flows after being purified in the lungs. But though the Dipnoi seem to be in advance with regard to these matters, it is a curious thing that, with regard to a spinal column and limbs, they are decidedly behindhand. For the back-bone is a gristly rod, like that of the Lamprey, and the limb is a simple-jointed rod, with a pair of fine fin-rays on each joint. The habits which give to these fishes the name of "Mud-fish" are thus described by Prof. Huxley:—"The *Lepidosiren* of the East and West Coasts of Africa has a habit in the dry season, when the water vanishes, of burrowing into the mud, taking care to leave a hole communicating with the atmosphere. Here the fish remains enclosed in mud, which, by drying, becomes of brick-like hardness, and it is said that in this state they have been brought into this country, where warm water is only required to disintegrate the clay, when the fish emerges, active and voracious."

This completes the fishes. And now let me introduce to you a little fish-like animal.

This little creature has a rounded fish-like body, through which, instead of a jointed back-bone, a gristly notochord runs, and, like the lower fish, it has no limbs. To enable it to get about, however, it is furnished with a long tail, which supports a broad fin, and by waving this to and fro it progresses quickly through the water. Like the lower fish, too, it has holes on each side of its neck through which two pairs of breathing-tufts or gills are situated just behind the holes. It has a rounded, sucking mouth, like a Lamprey. It also has the ordinary type of fish-heart—two chambers, auricle and ventricle. In fact it is a fish. But as this fish grows, changes take place. The gristly notochord separates into joints, and becomes bony: it is converted into a true spinal-column. Next two pairs of little limbs make their

appearance, budding out, one pair on the fore, the other on the hinder part of the body, and these each divide into five fingers at their extremities. Now, just inside the body a pair of little bladder-like organs begin to form behind the breathing-holes—these are the lungs, and as they become larger the gill-tufts become smaller, and the fish-like heart of two chambers gains an extra one and now consists of two auricles and a ventricle. During all the time these new organs are developing the tail gets less and less, and at last vanishes: the little limbs have grown into long legs, and—the fish has become a Frog. We now see why naturalists class the fishes, and the Amphibia to which the Frog belongs, in one group, the Ichthyopsidæ, or fish-like animals, for, as we have seen, there is no difference between the fishes and the amphibians in their earlier life. In other Amphibia we see forms which do not throw off all their fish-like characters as thoroughly as the Frogs and Toads, for the Efts retain their tails, and some of the Salamanders keep their gills even when they have acquired lungs. But however interesting these Amphibians—animals which live part of their life in water and part on land—may be, I must pass over any detailed description of them, and may be excused doing this, perhaps, as types of the other groups are not very familiar, being more often heard of than seen, as the Siren, and Axolotl and Proteus of the cave-rivers of Austria.

I will now consider the great province of Sauropsida, or Reptiles and Birds. These lay eggs with a large yolk, and when hatched the young being emerges from his shell a perfect little reptile or bird, as the case may be, and goes through no preparatory stage of lower life after coming into the world.

The first class is that of the Reptiles, and of these I will start with the Chelonina, or Tortoises and Turtles. I suppose you are all familiar with Tortoise-shell in some shape or form; this horny substance represents the epidermis or, roughly speaking, the skin. If you have seen the skeleton of a Tortoise, you will have noticed that underneath this horny shell is a thick, bony structure which really gives the Tortoise-shell its strength, for there are stories extant of their being

run over by carts and undergoing various similar accidents without injury. Here is a rather mutilated specimen of the skeleton of the Common Tortoise. Now, all the upper parts of this strong roof, or carapace, as it is called, are actually parts of the spinal-column and the ribs. Those plates which form the border and those forming the large plate under the body, known as the plastron, are formed in the skin. So you see, this bony covering, which you must not confound with the Tortoise-shell, is a very complicated affair. In the Tortoise class there are no teeth, the immensely-strong jaws being sheathed in a horny covering. Some of the Tortoises which inhabit fresh-water in hot countries have a soft skin in place of the bony case, and their limbs, which in the land-Tortoises have feet with five digits, are flattened to serve as fins. Other kinds inhabit marshes; and others, which you know as Turtles, live in the sea.

The next group of Reptiles is known as the Plesiosaurs, and these happily are, and have been for probably many millions of years, extinct. We find their skeletons in the clays and limestones at Whitby, and Lyme Regis, in Dorsetshire; and we can tell from their characters that they were the veritable dragons of the ocean. Their most curious feature was their neck, so long and pliant as to resemble that of a swan, and it has been suggested that they lurked in shallow water with only their small head above the surface and watched for their prey, darting out to seize it when within sight, propelled by their powerful paddles. These paddles had a most curious skeleton to support them, consisting of an immense number of small bones embedded in gristle, which would render them very pliable, and form altogether a most excellent organ of locomotion in the water.

The next order is that of the Lizards, distinguished by their active habits, as anyone who has watched our little English Lizard knows. A great many of the Lizards are most interesting, among which I may mention the Geckos, for instance, which inhabit hot countries, and are able to run quickly across a ceiling or wall. This they do, holding partly by their sharp claws, and partly by means of the little suckers

of skin under each digit, which act like the round leather suckers which boys sometimes make.

One large extinct Lizard is interesting to us from the fact that its remains are found in the chalk.

There is one curious little Lizard, the Slow Worm, which is generally taken for a Snake. This is an excusable mistake though, for its general shape is very Snake-like; and its limbs, though present, are invisible, lying beneath the skin, and are quite rudimentary. It has the power, in common with some of the other Lizards, of parting with its tail when suddenly touched. The first specimen I caught, which was on Box Hill, shed its tail in this way.

And now we come to a most dangerous group of Reptiles—the Snakes. These are remarkable for the immense number of joints which go to make up their spinal-column. In the Python, for instance, they are more than 400 in number. This Python is a non-poisonous Snake of the same division as that to which the Boa-constrictor belongs, and we can see that this structure of back-bone must be very suitable to their habits in giving them a very pliant body to wind round and crush their prey. The joints fit together by a cup-and-ball arrangement, the cups being very deep. In some of these Snakes, as the Boa, there is a little imperfect hind limb, which is of no use to the creature, as it lies beneath the skin; nevertheless it would be a mistake to say that Serpents have no limbs.

For a type of poisonous Snake I take the Rattlesnake. The large deep poison-fang is moveable on a hinge, so that when the Snake's mouth is shut it lies back against the palate, but by the pulling of the muscle which opens the mouth this fang is pushed by the other bones downwards and forwards, as in the figure; and when the Snake "strikes," the poison is injected into the wound through the fang, which is hollow. Says Prof. Huxley in one of his lectures, "The Snake makes a dart forward and bites, and then withdraws and waits until the victim dies, when it is swallowed with ease and satisfaction."

The next group, the Crocodiles and Alligators, are very Lizard-like in form, and are covered with an armour of bony

plates, and over these is a skin with scales taking the same form as the bony plates beneath. Now that Alligator-skin has become a fashionable material for the manufacture of bags and such-like articles, I dare say you have noticed this skin tanned and made into leather. A curious thing in the internal structure of the Crocodile is the gizzard containing stones, which it swallows. It is a very careful mother, laying its eggs in the sand and often watching them until hatched. The Crocodiles are very fond of basking in the sun on the mud at the sides of rivers. They lie on their stomachs, with their mouths wide agape, and a curious little bird is in the habit of hopping in and out of the open jaws to catch the flies and other insects which settle there.

And now we come to a very extraordinary group—the Ornithoscelida. Some of the forms composing it were of the largest size, but their principal interest lies in their bird-like characters, and these are seen principally in the hind limb. A peculiar feature of the thigh-bone is that its head turns inwards sharply, as it does in birds. This enables the Reptiles to walk with their feet pointing forwards, as do the birds, and differently to other Reptiles whose feet sprawl outwards, as seen in the Common Lizard, where the head of the thigh-bone is nearly straight. Again, in connection with this curious feature of the hind legs is the fact that the fore limbs are comparatively small and weak, and from this we infer that these strange Reptiles walked about on their hind legs, like the birds.

The last group of Reptiles is a most striking one, that of the Pterosauria. These had a very bird-like head, armed with large, sharp teeth in most cases. They had Bat-like wings, which, when they wanted to fly, were kept spread by the immensely-long fourth digits, the four joints of which extended along the front border. This structure gives its name to one genus of the group, the Pterodactyl, meaning wing-fingered. The other three digits had claws. These Reptiles, which are quite extinct, grew to a great size; the remains of one found at Maidstone measured sixteen feet from tip to tip of its wings, and an American specimen was twenty feet in the same direction. It probably fed on fish.

The second class of the Sauropsida comprises the birds, and these are so numerous, and the characters by which they are distinguished are so slight, that my best plan is to make a few general remarks about their characters as a class, and then mention a few of the more striking forms.

The bird's heart always has four chambers, two auricles and two ventricles, and breathing is effected by two lungs attached to the inner surface of the back. A character peculiar to the birds is the possession of air-sacs. These are a kind of bladder, some of which are situated in the chest, some in the abdomen, and others beneath the skin. They are connected with the lungs, and are capable, through those organs, of being filled with or emptied of air. Their use is very obvious. Hold a common air-ball some distance above the ground, then drop it, and note how slowly it falls; but let the air out and drop the empty skin, and how quickly it touches the ground. If we then imagine the bird to be partly composed of air-balls (as it literally is), how much greater buoyancy the body of the creature possesses when these are filled than when they are empty. There is another point of structure displayed by the birds, though not entirely confined to them, as they possess it in common with the bird-like Reptiles I mentioned just now, and also with the Crocodile. This is the possession of pneumatic bones, that is, bones which are filled with air instead of marrow. These bones, among which are the shoulder-bone, the breast-bone or sternum, the ribs, the blade-bone, the thigh-bone, and even some of the joints of the spinal-column, are the largest and heaviest in the body, and thus acquire greater lightness. Their hollow interiors are in connection with the air-sacs, and through these, of course, with the lungs. The celebrated surgeon, Hunter, actually made a Pigeon breathe through its shoulder-bone by cutting the bone through, and then tying up its wind-pipe. It is worthy of remark that neither the Gulls, the Penguin, nor the Ostrich possess these pneumatic bones.

Now, in direct connection with a bird's power of flight we note two things, the peculiar development of the breast-bone, and the large size and flat shape of the shoulder-bone. These

two bones receive all the attachments of the great flying-muscles which constitute the "cuts off the breast" of the chicken we have at dinner. The arm of a bird is, as might be expected, modified in such a way as to fit it for a very good organ of flight. First the large humerus or shoulder-bone, then there are two fore-arm bones, the radius and ulna, then follow two wrist-bones, to which are attached three digits, the thumb, fore finger, and middle finger. The thumb is freely movable, and in many birds has a claw at the end. In the Ostrich both the thumb and fore-finger have claws. The bones corresponding to the back of the hand are partly run together and cannot move independently of one another, and it is not at all necessary that they should.

In the digestive organs of birds probably the most important part is the gizzard. This is a thick, muscular chamber kept well supplied with pebbles, and this arrangement takes the place of the masticating-jaws of other animals. This organ, we have seen, is possessed by the Crocodiles.

The outer covering of birds—the feathers—is very characteristic. They correspond to the scales of reptiles and fish, and the hair on the skin of the higher animals, but are much more complicated in their development, which I will explain. A small pit exists in the skin, and from the bottom of this there projects a long, spongy papilla, which does not remain smooth, but presents upon its outer surface a deep groove in the middle line. From this groove other smaller grooves extend round the papilla, and, gradually becoming shallower, meet on the opposite side. Then other grooves grow between these last grooves. The whole increases in length, and becomes horny and hollow by the withdrawal of the soft pulp inside; and when it becomes dry it splits all along its three sets of grooves, producing what we know as the feather, consisting of a hollow, round quill and a square shaft, the shaft bearing a vane or vexillum on each side, such vane being made up of barbs lying close together, and attached to one another by hooks, known as barbules.

Now, the tail of the ordinary bird terminates in a large, flat bone, which really consists of several joints of the spinal-

column run together into one; and this bone, which from its shape is called the ploughshare-bone, supports several feathers of the fan-shaped tail.

All the characters I have described belong to the great majority of birds, but I will now briefly describe a bird which is not of the ordinary type. This is an extinct fossil bird, known as the "*Archæopteryx*," a word signifying "ancient wing." In this bird, the tail, instead of being short and clumped-up into a large bone at the end, is very long, in fact longer than the body, and consists of a series of slender bones, each of which bears a pair of tail-feathers. All the three digits of the hand have claws, and the bones corresponding to the back of the hand are not run together, but free and movable, and more like the Reptile-hand. The jaw-bones, instead of being cased in horn to form a beak, as in our existing birds, were furnished with sharp, reptilian teeth. Now, all these features showed that it was very much like a Reptile, and Prof. Flower goes so far as to describe it as "half-lizard and half-bird."

There are other birds known, but all extinct and fossilized, which also showed that certain parts were very Reptile-like; and, as we have seen that there are some Reptiles very like birds in some respects, you will see the force of classing the Reptiles and birds together under one heading—that of *Sauropsida*.

I must now pass on to the last great division—the *Mammalia*, or animals which feed their young ones with milk. The first division,—that of the *Monotremes*, which approaches most nearly to the reptiles and birds,—is represented by two small animals, of one of which I have a specimen here. It is known as the Duck-billed Platypus, or *Ornithorhynchus*. This curious little beast lives in holes in the banks of streams, paddling about the mud and swimming in the water by means of its webbed and clawed feet, catching the insects and shell-fish. It lays eggs, too, like those of a bird, and sits on them to hatch them. The young one, when it emerges from the shell, is soft and hairless, and one might consider with reason that its Duck's-bill would not be very well

adapted to suck milk with. However, this difficulty is overcome by the circumstance that the teat of the mother is not of the ordinary type,—like that of a cow, for instance,—but is actually a pit, into which the young one sticks its head. These Monotremes are found only in Australia.

The next division is that to which the animals known as Marsupials belong (Lat. *Marsupium*, a pouch, because they possess a kind of pocket). This division includes the Kangaroos of Australia and the Opossums of America. When the young are born they are very small and weak, and though they have the ordinary mammalian mouth with lips, they are not strong enough to suck milk; so the mother puts them in her pocket, where the teat is, to which they immediately stick, and the milk is actually squeezed into their mouth by the action of muscles. “After a time,” says Prof. Huxley, “it gets strong enough to put its head out of the pouch. Then afterwards it leaves the pouch for a little time, returning to feed, and this goes on till it becomes strong enough to shift for itself, when the mother dismisses it.”

The next division is that of the Edentates, a term which means that the members of it have no teeth; but this is not correct, as many of them have them; but they are not like ordinary teeth; they have no enamel, and the animal is not troubled by having to cut a second set, for one set suffices throughout their life. This group contains the Sloths, inhabitants of South America which spend a curious life, suspended back downward from the branches of trees, to which they cling by their peculiar feet, the soles of which face inwards, or, as Prof. Huxley calls them, naturally-clubbed feet, aided by the long claws. These Sloths feed on leaves.

We can hardly imagine a mode of life more unlike that of the Sloths than the one followed by the Ant-eaters, another branch of the Edentates. These also have club-feet armed with immensely-strong and sharp claws; but they use these not for hanging from branches by, but to tear open the nests of the White Ant, on which they feed. The tongue is very long and narrow, and covered by a sticky secretion. They poke this into the nest, and pull it out covered by Ants, which they swallow.

The other groups of Edentates are represented by the Armadillo, and Manis, or Pangolin. These little animals are covered by bony plates or scales. The Manis, which is the one covered with scales, certainly bears a great outward resemblance to a Lizard, while the Armadillo, with its bony case, may be compared to a Tortoise. This resemblance, however, is only outward, for the Tortoise-carapace was partly made up of the ribs and the back-bone, while the plates of the Manis and Armadillo are merely an altered skin. The fore-feet of the Manis are not clubbed, like the Sloth's, but they have their peculiarity, for the digits are doubled-up under the foot, so that they walk on their fists. The Manis feeds on Ants. The leg-bones of the Armadillo are immensely heavy and strong. It has a fore-foot with five digits, each with a claw. Other parts of its skeleton similarly indicate its habits, which are those of a burrowing animal. "It is said that no animal exists which is able to dig holes at such a rate as the Armadillo. In consequence of the ease with which it does this," I quote from Huxley's lectures, "it does not live habitually in one burrow, but scoops out one wherever it happens to be, when desiring to sleep."

As we get higher in the scale we come to groups of animals which are more familiar to you. Thus we have comprised in the next group such animals as the Horse, and Pig, and Ox, which may be seen in our daily walks; and others, such as the Hippopotamus, Rhinoceros, and Camel, which are among the more prominent inhabitants of the "Zoo." I will therefore not describe them individually, but will point out the distinguishing features of their different classes, and any curious particulars worth noting.

The next division, to which the Horse belongs, is a large one, and has had the name of Ungulata given to it in consequence of its members walking on their hoofs (Lat. *Ungula*). Some confusion commonly exists in people's minds as to the parts of a Horse's leg. Thus we often hear of a Horse falling and cutting its knees, but it is really the back of the wrist which gets injured, the bones corresponding to the back of the hand being very long. The same general structure holds good

in the hind limb, for the great joint which projects behind, and looks something like a knee pointing the wrong way, really answers to our heel, the animal, like the rest of the Ungulates, being perched on tip-toe.

The fact that some of the ungulate feet are what is called cloven divides the order into two groups. Now the difference between the cloven and the uncloven hoof is this. The middle or third digit of each foot has each of its sides similar, so that the whole is complete in itself just as each half of one's head is like the other, and both make a complete head, and on each side of this digit the other digits, similar in form to the first, are placed. But in the cloven hoof the third digit is lob-sided, and the fourth is also lob-sided, but reversed, and so faces the third, thus making a pair. The other digits are either like the third or fourth, according to which side they are on. The uncloven kind includes the Horse, Rhinoceros, and Tapir, while the cloven-footed are further divided into "cud-chewers," or ruminating animals, as the Ox, Deer, Sheep, Camel, and Giraffe; and those which do not ruminate, as the Pig and Hippopotamus.

The stomach of the ruminating animals is peculiar in structure. The stomach of the Camel has a curious apparatus. Part of its surface is studded with little pockets with a very narrow opening. These strain off the moisture which is not wanted at the time, and store it for future use. The pockets close so completely that it is said the stomach of a dissected Camel may be dragged about the floor without a drop of the water getting out.

The Cetacea, which are popularly supposed to be fish, include the Whales, Dolphins, and Porpoises. They are very far removed, both in their habits and structure, from fish. They most certainly do not lay eggs; they feed their young ones with milk. They have the four-chambered heart of the Mammalia; and their limbs, though unlike the ordinary type of Mammal, are very far indeed from being fins. The tail, which is the principal organ of locomotion, is a thick flap of skin, and this is horizontal, and not vertical, as in the fishes.

The order of Carnivora, or flesh-eating animals, to which

we have now come, is divided into two groups—those living on land, which have their digits separate, as the Cats, Dogs, and Bears; and those living in water, which have their digits joined together by skin, forming a kind of webbed foot; such are the Seals. They are all characterised by their teeth, which have a very bloodthirsty appearance.

In one kind of Seal—the Walrus—the upper canine teeth have become ridiculously prominent, though their look belies their nature, as in the ordinary way the Walrus is a harmless beast, and uses them as pick-axes with which to disinter the shell-fish at the sea-bottom, though when attacked they use them with terrible effect as offensive weapons. There are two other kinds of Seals—the Sea Lion, or Eared Seal, and the Common Seal. The Sea Lion is able to use its hind limbs for walking on land, which it does in somewhat ungainly fashion, as these limbs strongly resemble a pair of hands fastened together by the front of the wrists. The Common Seals, when they want to move, are obliged to set up a kind of gallop, and they have to execute this on their stomachs, so it is not very easy or graceful.

Now, a great deal has been written about the Proboscidea,—the Elephants,—some of which you have no doubt read, so I will merely mention that the Indian and African kind are not now regarded as belonging to the same genus, the African being called the *Loxodon*, from its peculiar teeth. The wise-looking head of the Elephant is, sad to state, a sham, as his intellectual-looking forehead does not cover brains, but only spongy bone, the brain being contained in a comparatively small hollow.

I will pass by the Rodents, or gnawing animals, among which are the Rabbits, Porcupines, Squirrels, and Mice, which follow the most diverse habits of life, although they are all characterised by the possession of sharp-cutting front teeth, or “incisors.”

The next order—the Insect-eaters—includes the Hedgehog, the so-called Shrew-mouse, which is not a Mouse at all, and the Mole. From personal and, I may add, painful experience, I differ from those who maintain that the Hedgehog's spines are used only for defensive purposes, for one which I kept in

the house for some time had the habit, when a hand was placed near him, of erecting his spines and making a sudden jump, the effect of which was somewhat startling, and causing a sharp withdrawal of the offending hand.

In the Cheiroptera, or "hand-winged" animals,—the Bats, we get a third kind of flying apparatus. That of the Reptile Pterosaurs I have already described, and you will remember that the flying-membrane was kept spread out by the long, fourth digit. The bird's wing was on a totally-different plan, and now in the Bats we get an organ more like an exaggerated webbed foot, a membrane spread out by the long, thin digits.

We have now come to the last division,—the Primates,—which include the Lemurs, Apes, and ourselves, who are much-advanced Monkeys. The Lemurs, which inhabit Madagascar, South Africa, and India, are very Monkey-like in their mode of life, living in trees; but, like the Bats, they usually select the night-time for their period of activity. They eat fruit, insects, and catch sleeping birds and devour them. Their eyes are usually immense, and it is a comic sight at the "Zoo" to see these great optics gazing at you with the most astonished expression out of dark cages.

These Lemurs and the Apes used to be classed together under the term *Quadrumana*, which means a four-handed animal; and I was recently rather astonished, on looking into the usually-accurate 'Wood's Natural History,' to find him asserting that—"In addition to two hands formed like those of man, their feet are also formed like hands, and are capable of grasping the branches, among which most Monkeys pass their lives." Now we must draw a careful distinction between the form of anything and the use to which it is put. Otherwise we run the chance of making endless confusion between structures as dissimilar as the wing of the bird and the membraned hand of the Bat. The hind-foot of the Monkey is not formed like a hand, but possesses the skeleton of the higher mammalian foot; and if it has great holding powers, why, so has a baby's foot, and so has the foot of the Australian savage when he drags a spear through the grass,

holding it by his toes, as he walks towards his enemy, to conceal from him the fact that he is armed. There is some difference between the hand of the Monkeys found in the Old World and those living in America. The thumb in the Old World Ape is what is called opposable to some extent, that is, he can place it some distance over the palm of the hand.

The New World Monkeys of America, which are the kind which organ-men take about, grasp a nut which is offered to to them in the palm of the hand with all the fingers.

"The consequence," says Prof. Huxley, "of being able to place the thumb quite on to the palm of the hand, that is, of having a thoroughly opposable digit, such as we possess, is enormous: we get thereby a power of estimating things in space, which Monkeys do not."

With this I will conclude. I have endeavoured to give you a general idea of the scheme which is followed in studying the Vertebrates, and in doing so have led you from the simplest known form—the Lancelet—to the highest yet developed—Man, and it only remains for me to thank you for the patience with which you have listened to a long address.

Mr. Albert J. Crosfield read a paper as follows:—A NATURALIST'S RAMBLE ROUND REIGATE, during the first week in June.

Starting from Oxford Road, Redhill, a walk of a few yards took us into the sandy lane with high, wooded banks, known as Batts Hill. The banks had been brilliant with Bluebells, but they were now withering.

We noticed, too, on the banks, abundance of Dog Mercury, a very poisonous plant; and the curious little Moschatell, with its five tiny green flowers arranged in regular order in a close cluster at the top of the flower-stalk. Not only does this little herb clothe with green our shaded banks, but in the cracks of limestone crags in Scotland, up to 3000 feet above sea-level, you meet with it where many plants that are its neighbours in Surrey could not find a living.

Overhead the Chiff-chaff repeated its call, "chiff-chaff, chiff-chaff." Almost the smallest of our British birds, one

wonders how so tiny a throat can send forth such a volume of sound. A Blackcap was singing in the laurel just over the fence; we now and then caught sight of its jet-black crown; its voice rivals the Nightingale's. The hen bird, with the ruddy crown, was most likely sitting on a shallow, slightly-built nest of dry grass, in some bush in the private grounds. Her mate will take his turn at sitting by-and-bye.

As we went up the hill towards Wray Common we left the sand behind and came to the clay. We noticed as we ascended that the oak-trees on the clay are more stunted than those upon the sand.

Wray Common is comparatively unproductive ground, so, after pausing to admire the prospect, we hurried across it and turned up Wray Lane, leading up the shoulder of the hill, towards the Suspension Bridge. The lower part of Wray Lane is shut in by high banks and hedges, producing a few wild strawberries, and here and there some plants of Woodruff. When dried the Woodruff is very fragrant, like hay of the best quality. The hedges are tangled with wild Clematis and the two Bryonies, all of them south-country plants, not found wild in Scotland and scarce in the North of England. The Black Bryony belongs to the Yam tribe, all its near kinsmen being tropical plants, and one of them, the Yam, being as important an article of food in the tropics as potatoes are in England.

The White Bryony has leaves the shape of melon leaves, and belongs to the Gourd tribe. The berries of both Bryonies are hurtful.

Before reaching the edge of Gatton Wood, an old ash-tree in the right-hand hedgerow attracted attention. There are several likely-looking holes in it, and one of them has been occupied by a pair of Nuthatches. About three weeks previously a friend of mine climbed up to it. The mouth of the hole had been newly plastered with hard, sandy clay, leaving a round entrance just large enough to let the old bird through, but too small for a man's hand to go through. On breaking away some of the clay he found that the hen Nuthatch was on her nest, which consisted of a few broken

bits of loose wood and dead leaves, and contained four eggs. The ground colour of the egg is white, and they are blotched with purplish spots.

On the edge of Gatton Wood are several likely Yew-trees. Putting our hand into a hole in one of them, a snap and a hiss from within caused an involuntary and rapid withdrawal. On casting light into the hole a Great Tit was seen, zealously guarding her eight young, in a nest of wool, feathers and hair.

Another Yew, at a height of about eight feet from the ground, divides its main trunk into three branches. In the hollow of the bowl between the branches was a neat little nest of dry grass, lined with feathers. Six young Creepers came fluttering out of it. Two, when caught and placed on the tree, clung to the trunk with their claws, pressing against it with their tails.

On the bank below Wray Lane we found the nest of a Wood Wren. Sharp eyes were needed to spy it out, so slightly is the dome raised above the surrounding Ivy. At a careless glance it looks like some stray wisp of dry grass, but on looking closely we saw beneath the grassy dome the entrance to the nest, and within were six eggs, spotted thickly with deep, purple-red spots on a white ground. The alarm-note of the old bird told as plainly as need be that the nest was there and only required a careful search to find it. Both bird and nest resemble its more abundant congeners, the Willow Wren and Chiff-chaff, but the absence of feathers in the lining of the nest identifies that of the Wood Wren, and the closer, darker spots identify the eggs. The song of the Wood Wren (I quote Harting's description of it) "has a graduated strain of twelve or fourteen notes, begun high, and finishing in demisemiquavers *diminuendo*. A peculiarity in this song is that the first four or five notes are repeated *moderato* and *staccato*, while the remainder is hurried to the end." Gilbert White's description of it is, "A little yellow bird still continues to make a sibilous, shivering noise in the top of tall woods."

The most interesting plants on the wooded slope below Wray Lane are the Wood Spurge and the White Helleborine.

The acrid, milky juice of the Spurges is sometimes used to cure warts, on which it acts as a caustic. All our British Spurges are herbs, but large forest trees in some parts of the world belong to this order of plants, to which we are also indebted for castor oil.

The White Helleborine is an Orchid, with spikes of ivory-coloured flowers, and broad, smooth leaves. The yet broader leaves of another Helleborine may be seen here and there amongst the bushes, but it does not blossom till August. A few plants of the Fly Orchis were met with in grassy places, and a little higher up, where the banks are barer, the greenish-yellow spikes of the Man Orchis were seen. It must be admitted that the resemblance of the flowers of the Man Orchis to a man is rather remote. The legs are there, and a cap or hood, but the body is almost wanting.

In a low bramble-bush we found a Whitethroat's nest, containing five eggs of a yellow-ochre colour of two shades. The nest of dry grass was deep in comparison with its diameter. The male Whitethroat, from a hedge not far distant, kept rising in the air with a jerky flight, warbling out its weak though cheerful song, and dropping back again into the bushes.

Instead of going right up Wray Lane we preferred striking down the bank, and then facing up the steep south slope of the hill straight towards the Suspension Bridge.

On this hillside, amongst the Juniper-bushes, the Sweet-scented Orchis abounded, its lilac spikes forming heads three to four inches in height. Here, too, was the tiny, white Eye-bright, with its violet-and-yellow-streaked lip, the scentless Mountain Woodruff, the Milkwort (purple, blue, and white), the Yellow Rock-rose, and the Fairy Flax, not blue, like the eyes of Longfellow's maiden, but white and fairy-like. We noticed, too, a few bushes of Sweetbriar Rose, the unfolded buds of which were tinged with deep pink, and the leaves when bruised were very fragrant.

A thickish tangle of bushes attracted us, and not in vain, for near the middle of the clump, in a small Wayfaring bush

and partly supported by a bramble, was the nest of a Red-backed Shrike, with the hen bird on it. The nest was made of stalks and moss and small roots and one or two feathers, and was lined with fine roots and a little Clematis-down. It contained four eggs, not of the most ordinary type, but having a white ground, blotched with grey chiefly at the thick end. The male Red-backed Shrike took his stand upon the top of a thorn-bush not many yards distant, where he sat twitching his tail up and down and making an angry chatter. A very handsome bird he looked, with his ruddy back, slaty forehead, and cream-coloured breast.

As we ascended the hillside we came across several fawn-coloured shells of the large Edible Snail. Each shell measured from one and a-half to two inches across. The snails are reputed to be rich eating when properly cooked.

Amongst butterflies the Common and Chalk-hill Blues and the Small Coppers were enjoying the sunshine, resting on the yellow flowers of the Bird's-foot Trefoil or on the tall, blue spikes of the Viper's Bugloss.

Wandering a few yards to the right, as we neared the top of the slope, a bird was seen to leave a Juniper-bush, and a few minutes' close search revealed an undoubted nest of the Cirl Bunting. The nest was placed about $1\frac{1}{2}$ ft. from the ground, and was made of dry stalks of herbs and moss, and lined with a good deal of hair and a little rabbit-down. It measured five inches in diameter, and was rather a deep nest. In it were two young birds about a week old and one addled egg. The egg was a good deal like the Yellowhammer's, but the streaks were coarser and the ground colour a trifle greener. The cock bird came into a bush near, where he made a chirp of distress. We could see his black throat and the black on the side of his head, as well as the line of lemon-yellow over his eye.

Time did not allow of our loitering longer on this part of the hill, so we crossed the Suspension Bridge, noting the wide-extended range of view, including one or two houses near Tunbridge Wells to the south-east, Crowborough, the ridge of Ashdown Forest and of St. Leonard's Forest, and

Leith Hill, and more in the distance the South Downs, notably Chanctonbury Ring, fully thirty-five miles distant.

As we passed up the lane leading towards the Beeches, we could see the Crystal Palace standing up against the horizon to the north.

A belt of Beech-trees runs along the hill-top before the Long Beech Wood is reached. In one of these Beeches a hole about six feet from the ground had been partly plastered by a pair of Nuthatches. The clay was only round the top part of the hole, the bark of the tree forming the bottom of the circular entrance. The old bird flew near, making its loud, ringing whistle.

The ground under the Beeches is mostly bare, though a few rather stunted plants of the White Helleborine were found. The curious Yellow-Birds'-nests, parasitical on the Beech-roots, were not above ground at the time of our ramble.

Coming out again on to the open hill-top we found in a rough, stony field above the Rifle Butts the Blue Pimpernel, a weed of uncertain appearance, much scarcer than the Scarlet Pimpernel, but like it only expanding fully in the sunshine. Both the green, scentless Wild Mignonettes were gathered in the same field, and the Basil Thyme and Marjoram were in bud.

From the long grass on the verge of the hill a Partridge rose, disclosing sixteen olive-brown eggs, laid in a hollow in the ground.

In the next field, still going westward, we noticed the long, stringy, red fibres and white, cup-like flowers of the Dodder, growing upon the Clover, and living at the Clover's expense, an unwelcome guest from the farmer's point of view.

Having reached the chalk lane that leads from Reigate Heath to Walton Heath, we struck down the hill side for a few yards, passing some large Yew-trees near the top of the lane, and came out on to the open hillside beyond, amongst Juniper bushes. Here we heard the shrill, high, thrilling note of the Grasshopper Warbler. There were two birds, one of which allowed us to get near it as it sang. The

Grasshopper Warbler, both in size and manner of flight, resembles the Whitethroat. It would jerk through the air, dive into the bottom of a Juniper and re-commence its song. As it sang, its whole body down to the tail thrilled. The bird's back was dark brown, its throat white, the breast grey, tinged with dull yellow. The song closely resembles the chirp of a grasshopper. It can be heard at a great distance, but does not sound loud when you are close. We searched amongst the herbage at the foot of several Juniper-bushes, but failed to find the nest.

This part of the hill yielded a Yellowhammer's nest, built of dry grass at the foot of a Yew-bush, and a Linnet's nest with one egg in the top of a small Yew.

Having crossed the lane again, we worked our way downwards amongst the Yew-bushes, when suddenly a bird about the size of a Cuckoo rose from within a few feet of us. From its flight, as well as from its mottled back, we saw that it was a Nightjar. Though we marked the exact spot whence it rose, it was a good while before we discovered two marble-like eggs, mottled with ash-grey and yellowish brown, laid upon the bare ground without the faintest trace of a nest. More than once we must have almost stepped upon them. We withdrew from the place for a while, and on our return we found that the bird had come back. As she sat on the ground, her mottled-brown back almost exactly resembled a log of wood. Her eye was half shut, the sunlight being too strong for a bird whose habits are nocturnal.

From a large Yew near the foot of the bank a Wood-pigeon rose with a great flapping, leaving her two white eggs in a shallow nest of sticks on one of the side boughs of the Yew.

Amongst the Yews on this shoulder of the hill we gathered the Dwarf Dark-winged Orchis, a species not very abundant round Reigate. Its sepals and petals are dark purple and green, its lip white with raised purple spots. Here, too, we saw the Bee-orchis coming up, but we were a fortnight too early to find it in flower. Some remarkably fine Fly-orchises were gathered in the hedge-row at the foot of the steep slope.

A pair of Nightingales were "churring" in the same hedgerow. They evidently were uneasy at our presence, but we could not find the nest, which most likely was carefully hidden under brushwood in the very thickest part of the cover. Nightingales largely employ oak-leaves in building their nests. The eggs are olive-green or olive-brown, almost the same colour as Partridges'.

We now turned down the lane leading southward from the hill to Reigate Heath. In the hedgerow we noticed several plants of the true Hemlock, growing four or five feet high. The leaves are specially graceful and fern-like, and the stem is spotted with purple spots. The whole plant is a deadly poison. In one of the valleys behind Box Hill the Hemlock attains a height of seven feet.

In a crack in the brickwork of an old lime-kiln on the right of the lane a Blue Tit had built a nest and laid seven eggs.

A damp copse just below the old kiln resounded with the notes of the Sedge Warbler, a bird which has great variety without having much richness of song. It often breaks off into a strange, grating noise, but all along seems to tell of buoyancy of spirits and vivacity.

We were greatly delighted at finding the Crimson Vetchling by the side of a small pond in a field to the east of the lane. Its pea-like blossoms are of a deep crimson colour; the leaves are grass-like. It is not a common plant round Reigate.

After passing under the railway, we paused for a few moments to watch the three species of Swallow circling over the surface of a pond on the roadside. The small mouse-coloured Sand Martins excelled at wheeling sharply round, and surpassed both the Swallow and Martin in the rapidity of their flights. The distinguishing points of each were well observed. We knew the Martins by their white, upper tail-coverts; the Swallows by their chestnut throats and deeply-forked swallow-tails: the Sand Martins, by their small size and plain drab backs.

Soon the sands of Reigate Heath were reached, the chalk

and clay being left behind. It was too late to go far on the heath, so we were content to cut across the N.W. corner, and then strike homewards. We had not gone far when a pair of Stonechats told us, as plainly as they knew how, that they had a nest near at hand. First the cock with his jet-black head, and then the plainer hen flew to and fro, making a "chat" of distress. After a while the hen Stonechat alighted on a certain tuft of Heather, and returned again to her perch on a Gorse-bush. She then went to the same tuft again, and then the cock went there. On her third visit the hen popped into the Heather, and on going to the spot we found a nest with six eggs. The nest was made of fine, dry grass, and lined with hairs, and was placed on the stalks of the Heather so that the Heather completely covered it up. The eggs were blue, slightly blotched with yellow.

Passing through one of the clumps of Scotch Firs we crossed over the low ridge running across the heath, and came to the Rabbit-warren on its north-eastern slope. In a Rabbit-hole we discovered a deserted nest of a Wheatear, placed about two feet from the entrance of the hole. It contained three pale-blue, addled eggs. A hen Wheatear kept restlessly flitting or running to and fro, with food in her bill, so she probably had young near at hand.

Hours might be spent with pleasure in examining the plants on the Heath, but our time is exhausted, and we must go no further.

Before sitting down, I wish to explain that the foregoing paper is not a work of imagination, neither is it a record of any one walk I have ever taken. Each nest described is a real nest, and each plant has been actually gathered in the place where it is described as growing. The descriptions are taken from diaries which I have kept extending over a period of about eighteen years. I would cordially recommend to the young the habit of making careful and accurate notes of what they see. Knowledge is thus acquired which forms a basis for further study; and the habit of observing is one which grows when cultivated, and which none of us can neglect without suffering loss.

EVENING MEETING.—APRIL 16TH, 1886.

Mr. Cooper exhibited plates of *Mesembryanthemum ficiforme* and *Aloe inermis*.

Mr. Edward Lovett read the following paper :—

NOTES ON THE ORIGIN AND DEVELOPMENT OF FLINT AND
STONE IMPLEMENTS.

The subject of this short paper is one to which a great amount of work and investigation has been devoted, and it is one of so wide and general a scope that it would be impossible as well as unnecessary to go into the history of stone implements in a single lecture. I have therefore confined my observations to a few ideas as to the causes which may have called into being the earliest form of implements and weapons with which we are acquainted; the progress which marked the introduction of skill and superior workmanship into the fabrication of those implements, and also such especial points of interest connecting this old pre-historical period with the present as may suggest themselves in the examination of this interesting subject.

It is perhaps almost impossible for the mind to imagine the condition and surroundings of the earliest human inhabitants of the earth, for as flint and stone weapons generally exhibit a gradual development from the crudest to the most finished types, it would be only natural to suppose that there was a period even earlier than that of the palæolithic era when man had not the remotest idea of making any sort of weapon, but simply used the first natural stone that came to hand in his rude endeavours to perform some mechanical act. Now this conjecture is not only a probable one, but it is borne out by actual recent examples. In Moseley's work on the 'Challenger' Expedition (p. 357), he states of the natives of Cape York, Australia :—" Their only stone implements are a round, flat-topped stone, and another conical one, suitable to be grasped in the hands. This is used as a pestle with which to pound their beans on the flat stone. Both stones are merely selected, and not shaped in any way." I could quote numerous other

examples to show how frequently stones are even now used in their natural and untrimmed condition. The position of primeval man must have been one of extreme danger and difficulty, if we may judge of it by the scant vestiges of that remote period. Surrounded by large animals, many of which were predatory and powerful; placed at a great disadvantage as regards his power of obtaining food; and living, as he undoubtedly did in caves or even in burrows in the earth, his lot was not a happy one from our point of view. And I am inclined to think that the very fact of his producing implements out of stone suitable in assisting him in his simple but urgent requirements, namely, food, most certainly proves that there was a real necessity for such weapons, and therefore a keen struggle for existence as against his numerous and powerful enemies.

It is quite possible, nay even probable, that earliest man was vegetarian, and for this reason: that such food was easy to procure, and required no apparatus to obtain; from this he might have become acquainted with land Mollusca, and then with Fresh-water and Marine Univalves and Bivalves. This, in fact, is strongly borne out by the existence of those remarkable mounds of shells so universally met with, and which generally contain implements of stone and other pre-historic remains. Again, deposits in which implements occur are more frequently than not found near the sea, or near ancient river-beds or modern rivers; and as primeval man had no means of obtaining water from wells or by artificial means, he was compelled thus to form his settlements near rivers, streams, lakes, &c., and he would then rapidly become acquainted with such easily-procured food as the Mollusca.

Under these conditions of life, implements and weapons might have been unknown, because not absolutely required; but a time came when such simple food was supplemented by that of a higher and better kind, when fish, birds, and mammals were discovered to be superior to such diet as Mollusca, and fruits or berries. Then it was that the ingenuity of palæolithic man contrived by the simplest possible means to devise some method of capturing or killing his food, or it may

have been that actual self-defence caused the killing of the first animal.

The first object that would present itself to the seeker for a weapon, or missile, would be a stone. Not only do we see this almost every day in our own civilized time, but in the actual absence of any other weapon, such an object as a loose stone would doubly suggest itself for the purpose in view. We thus see that pre-historic man's first weapon was in every probability a stone, and, as I have already stated, a natural stone; and it may have been long ere the natural rough flints or other hard stones gave place to worked specimens, the earliest types of worked implements show so little alteration by chipping that this view seems to me a very probable one.

Before, however, speaking of such implements, I will say a few words about flint from which most stone weapons were fabricated. In many parts of Europe flint occurs plentifully, not only *in situ* in the Chalk, but also in post-tertiary river-gravels. Chert and Chalcedony also are found, though in less quantity, and in granite districts quartz or quartzites presented a somewhat similar material. Now it is evident that primeval man was not slow to find out the advantages possessed by flint over other and softer stone. It broke with a sharp (often cutting) edge, it was of great hardness and durability, and above all, it was comparatively easy to obtain.

It is remarkable that worked flints and flint flakes are often found in places where flint is not found naturally. The best instance I have seen of this is in a cave I examined in Jersey. The island is composed almost entirely of igneous rocks, with a few tilted beds of clay-slates, &c. Yet in a cave in the Syenite rock I discovered a veritable pre-historic workshop: hundreds of rough weapons and thousands of chips and flakes were buried in a floor of decomposed felspar. Now, nowhere in the Channel Islands is there any chalk, and therefore no flints, so it is evident that flint, being an article of such value to early man, became, in a way, a considerable object of commerce.

In countries far remote, where flint is scarce or unknown, other forms of silica were called into requisition. From the

Cape of Good Hope I have a few early types made of a curious rock in which silica predominates. In the Admiralty Islands, in Mexico, and indeed in many other places, obsidian, a volcanic sort of glass, is extensively used; and it is of such value as a material for cutting implements that I understand some natives actually shave with flakes of this material. In the earth-mounds of North America thousands of beautifully-shaped weapons have been found of a kind of quartzite, and some of a fine milk-white quartz. I have also seen others of a crystal-clear Chalcedony, and others again, to which I shall refer later on, of Jasper and Carnelian, all of which stones are forms of silica.

As already stated, I believe that before man learnt how to fabricate any kind of weapon whatever he used such natural or rough stones as suggested themselves to his requirements. I have often found flints fractured by frost or other natural causes which were, in a way, nearly as serviceable as chipped weapons. From such rude models he would in course of time have tried to fashion suitable tools for himself, and he succeeded in a manner that must surprise everyone who considers what stubborn material flint is, and what difficulties must have presented themselves to a man with no other apparatus to fabricate with than his hands and pieces of stone as a hammer. Even in our own time the makers of gun-flints do not, even with their many forms of steel hammers, &c., get through their work without much practice and skill, and a gun-flint is a poor thing compared with a spear-head, arrow-head, or celt.

One thing is very certain and most interesting, namely, that the same wants and necessities called forth the same kinds of implements in all parts of the world where such things are now found, so that we find celts and adzes, piercers and scrapers, spear-heads and arrow-heads, knives and sling-stones, fish-gorges and fish-hooks, from the Arctic to the Antarctic regions, and from America to India and Africa. I will not go into the details of such common types as knives, arrow-heads, spears, celts, and such familiar objects, beyond referring to the specimens I have brought, many of which I

have restored in order to show more conclusively the purpose for which they were evidently intended. But there is one form which, in my opinion, has been as yet misunderstood, and that is the long, narrow flint-flakes and the short, curved fragments so often met with; the former are often called knives, and the latter scrapers or flakes simply. Now, by comparing these with a number of actual fish-gorges of bone and stone, and hooks of shell and bone and wood, which I have obtained from Fiji, the New Hebrides, Hudson's Bay, Alaska, and Queen Charlotte's Sound, it will be seen that if these dubious-looking flints be restored upon the same plan and by the same method of manufacture, a very serviceable set of implements is evolved.

Before what I would call the shell and bone age, there is every reason to believe that fish-hooks of an earlier type were undoubtedly used; for are not these remains most abundant near the coast and large rivers? And besides that, the shell fish-hooks of the present South Seas are contemporary with the polished stone period in those regions, whereas the crude flint hooks of the Jersey cavern were associated with an earlier type of chipped flints.

Since restoring and examining these early fish-hooks, I have seen several collections of implements, and have been much struck with many specimens (undescribed, or called scrapers), which, if mounted properly, would make good fish-hooks.

The fish-gorge, forms of which are still in use amongst the Eskimo, was doubtless the earliest method of catching fish; it consisted of a stone, or flint sharpened more or less at each end, and tied round the centre by the line. When baited with some fatty material, the gorge was placed in a line with the cord, and when swallowed by the fish a sharp jerk caused it to come at right angles to the cord and the gullet of the fish, thus fixing it firmly and enabling the fisherman to land his catch.

There is no doubt that many of the flint arrow- and spear-heads found in various deposits are really for fish-arrows and fish-spears; indeed, I am inclined myself to regard palæolithic

man as almost exclusively a fisherman, and neolithic man as nearly so. This idea is borne out by what we find as regards savages of to-day to whom metal is unknown, though such tribes are rapidly becoming fewer. The natives of the islands of the South Pacific, as well as the Eskimo of Arctic America, are fishermen, and using, till civilization reached them, gorges of stone and bone, and hooks of shell, bone, and wood.

In Central Africa the natives cluster round the great lakes, and even build houses on piles, like the pre-historic lake-dwellings of Switzerland, from which they sally forth on fishing-expeditions; and the Japanese and Chinese are so thoroughly fishermen that no country in the world shows such artistic skill and knowledge of the ocean-world, as native drawings of marine animals testify. These latter countries, however, have long emerged from the stone age.

Thus, then, I believe that many of the early types of worked flints will be better understood if we regard their makers and users as fishermen, and with this object I have restored many specimens to illustrate their possible use.

These specimens, together with several series of arrow-heads and other implements in flint, Carnelian, Jasper, quartzite, &c., were then described.

Mr. Lovett exhibited a fine series of flint implements, fish-hooks, &c., in illustration of his paper.

ANNUAL MEETING, OCTOBER 15TH, 1886.

The Annual Report and Balance Sheet were read and adopted, as follows:—

HOLMESDALE NATURAL HISTORY CLUB.

Annual Report, October 15th, 1886.

During the past twelve months twelve members and four subscribers have joined the Club, whilst seven have withdrawn, and one has died, leaving the present membership seventy-six, being an advance of eight as compared with the number at the last Annual Meeting.

We record with sorrow the death of our corresponding member, Dr. Power, which occurred at Bedford on June 9th, 1886. Dr. Power showed an active interest in the Club in many ways, and the Club Herbarium was greatly enriched by him.

The papers read at the winter evening meetings were equal in value to those of former years. A meeting, to which young persons were specially invited, took the place of our ordinary evening meeting in March. About 100 persons were then present, and the addresses were listened to with much attention.

At the meeting in February, instead of papers being read in the usual way, three subjects were chosen for discussion, in which many members took part, thereby adding greatly to the interest of the meeting.

The following subjects occupied the attention of the Club at the evening meetings:—

Oct. 16, 1885. 'The Yellowstone National Park,' by Mr. R. Miller Christy.

Nov. 20. 'Mahogany—Where Grown—How Obtained—Its Quality and Uses,' by Mr. W. H. Tyndall.

Dec. 18. 'Recent Additions to the British Flora,' by Mr. Arthur Bennett, F.L.S.

Dec. 18. 'Additions to the Surrey Flora,' by Mr. W. H. Beeby, F.R.M.S.

Jan. 15, 1886. 'The Marine Aquarium, its History and Management,' by Mr. E. Horsnail.

Jan. 15. 'Meteorology, 1885,' by Mr. W. H. Tyndall.

Feb. 19. 'Pond Life,' by Dr. Bossey.

Feb. 19. 'Origin of Hillocks on the Surface of our Commons,' by Mr. W. H. Tyndall.

Feb. 19. 'Winter Habits of Birds,' by Mr. James B. Crosfield.

March 19. 'How and Why Animals Differ,' Part II., Vertebrates, by Mr. Horace W. Gilbert.

March 19. 'A Naturalist's Ramble round Reigate,' by Mr. Albert J. Crosfield.

April 16. 'Notes on the Origin and Development of Flint and Stone Implements,' by Mr. Edward Lovett.

OUT-DOOR MEETINGS.—The following excursions took place during the summer; a full report on them has been prepared by the President:—

Whole-day.

- May 1. Epsom Downs and Mickleham.
- June 2. Tunbridge Wells.
- July 3. Frensham Ponds.
- Aug. 7. Caterham, Barrow Green Woods, and Oxted.
- Sept. 4. Ashdown Forest.

Afternoon.

- April 17. Reigate Heath.
- May 15. Merstham, Chipstead, and Upper Gatton.
- June 19. Reigate and Buckland Hills.
- Aug. 21. Merstham and White Hill.
- Sept. 25. Ranmore Common.

On the occasion of the excursions to Tunbridge Wells and Ashdown Forest the Club was joined by the Tunbridge Wells Natural History and Antiquarian Society; and the success of these excursions was greatly increased by the excellent arrangements made by the Secretary and other officers of the Tunbridge Wells Society.

A Photographic Section has been established in connection with the Club, about twelve members having devoted themselves to this branch of art, which may be made a most useful ally of Natural History study. Meetings of this section were held during April and May, and it is hoped that Photographic Meetings will be held monthly during the coming winter.

DONATIONS, &c. — ‘Proceedings and Transactions of the Croydon Microscopical and Natural History Club.’ ‘The Rochester Naturalist,’ April 1 and Oct. 1, 1886. Pamphlet, ‘On *Sparganium neglectum*,’ by Mr. W. H. Beeby; reprinted from the ‘Journal of Botany.’

EXHIBITS.—Oct. 16: a greatly-fasciated specimen of *Pyrethrum uliginosum*, exhibited by Mr. T. P. Newman; a fasciated Pansy and a fasciated Chrysanthemum, also plates of two *Stapelias* and a *Mesembryanthemum*, by Mr. T. Cooper. Nov. 20:

specimens of *Trifolium ochroleuctum*, by Mr. R. Noakes; *Calluna vulgaris alba*, by the Rev. J. Menzies. Dec. 18: specimens of *Salvia verticillata*, from Merstham, by Dr. Bossey and Mr. A. J. Crosfield; a map showing the distribution of *Sparganium ramosum* and *S. neglectum*, by Mr. W. H. Beeby; specimens of eighteen plants from Wensleydale, by Mr. A. J. Crosfield. Jan. 15, 1886: a Pear of abnormal growth, by Dr. Bossey. Feb. 19: an ornamental Roman tile from Dood's Farm, by Mr. A. J. Crosfield; plates illustrative of Pond Life, by Dr. Bossey. April 16: a spherical egg, by Mr. C. Ferneley; plates of *Mesembryanthemum ficiforme* and *Aloe inermis*, by Mr. T. Cooper; flint and stone implements, fish-hooks, &c., by Mr. E. Lovett.

THE HOLMESDALE NATURAL HISTORY CLUB. 1885—1886.

ABSTRACT OF ACCOUNTS.

Receipts.				Expenses.			
Oct. 1, 1885.	£	s.	d.	Oct. 1, 1885, to Sept. 30, 1886.	£	s.	d.
Balance	24	3	4	Rent	15	0	0
Oct. 1, 1885, to Sept. 30, 1886.				Gas and Firing	0	19	6
Subscriptions.....	28	11	0	Cleaning	1	2	0
Sale of 'Proceedings'.	0	4	0	Printing and Postages.	3	8	9
				Minute & Cash Books.	0	5	0
				Collector's Commission			
				and Postages	1	8	9
				Sept. 30, 1886.			
				Balance in hand	30	14	4
	£52	18	4		£52	18	4

Examined and found correct, { RD. NOAKES. }
October 12th, 1886. { F. G. CAREY. } Auditors.

The following Officers were elected for the ensuing year:—
President, Mr. W. H. Tyndall; *Treasurer*, Mr. T. P. Newman;
Secretary, Mr. A. J. Crosfield; *Curator*, Mr. John Linnell;
Committee, Dr. Bossey, Messrs. W. Brooks, F. G. Carey,
T. Cooper, J. B. Crosfield, J. I. Cudworth, Rev. J. Menzies,
Mr. R. Noakes, and Dr. Wheeler.

The following presentations were announced:—A pamphlet on *Sparganium neglectum*, by Mr. W. H. Beeby; 'Proceedings of the Croydon Microscopical and Natural History Club'; the 'Rochester Naturalist,' April 1 and October 1, 1886.

Mr. A. J. Crosfield exhibited a green Dahlia grown by Messrs. J. Cheal & Sons, Crawley. All the petals appear to have taken the form of sepals.

The following REPORT OF EXCURSIONS was read by Mr. W. H. Tyndall:—

THE EXCURSIONS OF 1886.

Having regard first to the whole-day excursions—

May 1st.—Three members and one visitor only made the party. Under the guidance of Mr. F. G. Carey, the party having met at Epsom Station, proceeded first to the mineral well, which at one time was a place of considerable resort. The well is now in private grounds, about one mile south-west of Epsom Station. It is not used for medicinal purposes. Dr. Bossey took a sample of the water, and also of the sediment at the bottom of the well, at a depth of about 12 feet. The water contained some living animalcules (*Vorticellæ*, *Paramecia*, a *Rotifer*, and an *Annelid*). The sediment consisted of sand, clay, chalk, building-rubbish, and much decaying vegetable-matter, all of them suggestive of some inlet of impure surface-water. Sand was present, consisting of portions of quartz, colourless, opaque, with yellow and brown sand. There were particles of clay and chalk. Leaving the well, the walk was continued over Epsom Common, and then through a lane leading to Ashstead Park. There was some remarkably fine timber, consisting of Oak, Elm, various kinds of Fir, and some very old Yews. A Roman stone street formerly passed through the Park, and some relics of it are said to be found in the material of which the church is built. The remainder of the excursion was confined to the high road through Leatherhead to the Box Hill Station of the South Eastern Railway.

June 2nd.—This excursion was to Tunbridge Wells, to meet members of the Tunbridge Wells Natural History and Antiquarian Society. About ten members of the Holmesdale Club were present, and a considerable number of the Tunbridge Wells Society. The excursion was directed to Eridge Castle, which dates from about the 13th century, but

many additions have been made to it at dates up to a comparatively recent time. There is some good carving, several fine pictures, and some of the rooms command pleasant prospects towards the south. It had been very hot during the morning, but a thunder-storm in the afternoon materially cooled the air. After the rain the party visited Eridge Rocks, which, like those at Tunbridge Wells, belong to the Hastings sand-beds of the Wealden formation, and present on one side a bold yet broken escarpment, while the top is covered with soil. They are evidently exposed by denudation, a strong current having at a former period washed away the loose soil or sand, leaving the rocks as cliffs by the sea-shore. Several Ferns were found growing on the rocks, but the *Hymenophyllum tunbridgense*, formerly so abundant, seems to be exterminated from all parts accessible to the common visitor.

July 3rd.—Frensham Ponds were reached from Farnham Station. Near Frensham Ponds are three conical hills called the "Devil's Jumps." They are the more remarkable as standing by themselves in a direct line, and within an area of half-a-mile in length. They are from 250 to 300 ft. above sea-level, the westernmost being the highest, and the middle one the lowest. On the top of the eastern mound is a mass of rock, apparently of indurated sand of the Lower Greensand formation; but the rock is much twisted in its formation, and has a tendency to form into pipes of greater or less length and magnitude. In the immediate neighbourhood of the middle mound these pipes are more distinctly formed, and are fairly abundant. They are filled with sand, and are formed in rings held slightly together at the edges, being in fact a number of short pipes joined together to make up the total length. The soil is greatly impregnated with iron, and the water of the wells suffers in consequence. In this district is the greatest extent of the Lower Greensand, forming a belt several miles in extent. It is the source to a large extent of the head-waters of the River Wey, which cuts through the North Downs at Guildford, and falls into the Thames at Weybridge. Scotch Fir grows on the heaths, and is largely self-sown. Several interesting plants were found on the

borders of the great pond (e. g.), *Littorella lacustris*, near the bathing-station; *Acorus Calamus*, at the western end of the lake; and the rare *Rivularia articulata*, which was so abundant in the water last year, was found again in considerable quantity.

Aug. 7.—An excursion in the neighbourhood of Caterham, striking eastward under the chalk-range. Turning out of the high road to Godstone, about a mile and a half from Caterham, the party entered a wood, through which at a former period the coach-road ran. In this wood may be found the greater and lesser Butterfly Orchis, &c.; and abundance of *Epipactis latifolia* was found. Leaving the wood, the path skirted the range of the chalk-hills, then mounted to the top of the chalk-range, continuing N.E. until overlooking the village of Oxted. The party descended the hill near some large lime-works, and proceeded to Oxted Station.

Sept. 4.—To Ashdown Forest. The Club met the Tunbridge Wells Society at Forest Row Station, and proceeded thence to Gipp's Gap. The views of the surrounding country were exceedingly beautiful, and, had the air been clear, would have been extensive also. The prospect from the highest point reached the South Downs to their termination at Beachy Head; to the east bounded by Crowborough, the highest point of the Wealden series. The North Downs may be traced for a long distance to the west and to the north-east. A boggy piece of land is near the foot of the hill, where were found *Lastrea Oreopteris*, Lady Fern, *Blechnum*, the Ivy-leaved *Campanula*, and Sundew.

Afternoon Excursions.

April 17.—To Reigate Heath, and on to Betchworth. The day was cloudy, with cold wind. The season was too backward for many plants to be found.

May 15. — To Merstham, Chipstead, and Upper Gatton. A large company met at Merstham Station. In the village the Rev. H. Brass pointed out an old house, probably of the 16th century. Lord Hylton kindly gave permission to walk through his grounds, and afterwards to see the chief apart-

ments of his house. He also directed attention to a preserved specimen of a White Badger which had been shot in the neighbourhood. The high road to London formerly passed through his park. The party then ascended the hill to Upper Gatton, passing not far from the seat of Mr. Charles Freshfield, where are some very fine Cedars. The walk was continued to Chipstead Church. The woods were gay with the Wood Violet, Primroses, and Hyacinths. The weather was remarkably fine, the air clear, the prospect from the high ground good, and the excursion generally very enjoyable.

June 19. — To Reigate and Buckland Hills. A party of about ten met at Reigate Station, and ascended Reigate Hill from Nutley Lane. They proceeded along the brow of the hill on to Walton Heath, then, turning into a copse, pursued a path skirting the Heath, gradually descending and passing through a grove of Yew-trees. Among other plants, *Ajuga chamapitys* was gathered on Buckland Hill. *Habenaria conopsea* was abundant. Fine plants of *Ophrys muscifera* were found, one plant of *Habenaria chloroleuca*, and one blossom of *Ophrys apifera*.

Aug. 21. — To Merstham and White Hill. Under White Hill the Everlasting Pea (*Lathyrus sylvestris*) grew abundantly on waste ground where quarrying for the Upper Greensand rock (Fire-stone) had evidently taken place.

Sept. 25. — Ranmore Common. Met at Dorking Station, and ascended to Ranmore; walked to Pickett's Hole, a beautiful spot on the brow of the hill about a mile and a half from the commencement of the Common. Near Dorking Station *Mercurialis annua* and *Diplotaxis muralis*, var. *Babingtonii*, were found. Near Pickett's Hole, the Rosebay Willow-Herb and Raspberry-plants were met with.

Mr. Benjamin Lomax, F.L.S., of Brighton, then proceeded to describe our BRITISH REPTILES. He alluded to the separation between our minds and the minds of lower animals, remarking that even the Wolf and the Wasp have been known to respond to kindness.

True reptiles are represented in Great Britain by three or

four Lizards and three Snakes; they are vertebrates breathing through their lungs.

Allied to the true reptiles are Amphibians, which are divided into those that have tails all their lives, and those that cast their tails. The former are represented in England by the Newt and Eft; the latter by Toads and Frogs. The tailless Amphibians enter life as perfect fish with gills. When in the tadpole state, they do much to keep ponds clear by eating impurities. The tongue of the Toad is hung the reverse way to ours, being hung from its lips. It breathes by means of bellows under its lip, and may be smothered by having its mouth held open. It sheds its skin, and eats it.

Reptiles are divided into four families, distinguished by their outer coverings of scales or plates:—Alligators, Tortoises, Lizards, and Snakes. In England we occasionally meet with the Green Lizard, *Lacerta viridis*. The little Brown Lizard is abundant. The Slow Worm also is shown by its skeleton to be a Lizard, having rudimentary legs; it has a small fixed mouth, and further differs from the Snakes in the absence of barbed scales.

Our only poisonous Snake is the Adder; in the front of the Adder's jaw are two bones containing long, pipe-like teeth, and at their base are the poison-fangs. The Smooth Snake is a scarce species, found in the New Forest. The Ringed Snake is abundant on boggy heaths; it has from 300 to 400 nervous centres, and is naturally highly sensitive.

Mr. Lomax exhibited living specimens of the Ringed Snake, Toad, and Slow Worm.

EVENING MEETING.—NOVEMBER 19TH, 1886.

Mr. J. B. Crosfield exhibited a branch of Raspberries in full fruit, and also a small branch of *Deutsia scabra* with about half-a-dozen leaves at the tip bright red, while the lower leaves were of the usual green colour; there was a ring round the stem immediately below the red and above the green leaves, from which the bark had been entirely removed, from causes unknown, and the scar had healed.

Mr. Cudworth exhibited two specimens of a fungus (*Helvella*).

Mr. T. P. Newman made some observations on the AURORA BOREALIS, and made especial reference to certain appearances in the sky seen at Reigate, known as Polar Bands. The following is an abstract of his remarks :—

One of the principal characters of the Aurora Borealis is its variation. Not only does it vary in form, but in colour, in height, and especially in intensity. And according to the intensity of the display, so does the distance vary from which it can be observed. The position whence it can be seen with the greatest regularity and in its greatest beauty is a zone a little within the Arctic circle, but stretching wider east and west, and especially west, than north and south, that is, almost an ellipse, having for its centre a point about midway between the pole and the magnetic pole. As the observer goes south from this maximal zone, the displays diminish in number and intensity, but they are still frequently seen until he comes to a zone which may be drawn through Edinburgh; south of that line Auroral displays are comparatively rare. In all this region, including points lying in the maximal zone, the crown of the arc—the Aurora is generally seen in the form of an arc—appears in the magnetic north, and the farther north the observer travels towards this zone the higher in the zenith will the arc appear. A little within the maximal zone, another line may be drawn where the Aurora may be seen directly overhead; and again, a little within this line, and the arc is seen to be in the south. Within this line the displays rapidly diminish, both in frequency and intensity, though it is improbable that they are altogether absent from any point within it.

In the year 1839 a great Aurora took place, which was observed in Italy, as well as in Cuba, and at New Orleans, in Connecticut, and so over a large portion of the Northern Hemisphere. The distance at which a display is seen depends more upon its height than upon its intensity. The contour of the globe makes it impossible for any display to be seen

from the equator, and the same applies in a lessening degree until the line through Edinburgh is reached. But as the Aurora gains an unusual height, so it may be seen from a point lower down on the globe's surface. The height of the Aurora is one of the great problems of the age. It is very variously estimated, and the circum-polar observers having made diligent observations, believe that we may safely place it at between 62 and 124 miles; but it had previously been estimated as low as 7 miles, and as high as 825.

The intensity of the Auroral light is not great; only in its most brilliant displays does it give sufficient to enable large print to be read, and it is insufficient for photography. It is by no means sufficient to light the peasants in their work in the total absence of the sun during the long winter.

The hissing and crackling sound, of which much has been written, is reported on the authority of one scientific party alone. All others record that it is absolutely silent, and this is now generally accepted.

The times and frequency of the display have been carefully recorded for many years. The daily maximum of intensity occurs about 9 p.m. There are two annual maxima, which are found at the equinoxes, while there are two minima, which occur at the solstices. From each equinox there is a gradual decrease until midsummer or midwinter, and then a gradual increase again.

Besides these annual periods, there are found to be periods of eleven years which give a clear maximum and minimum. These periods are found to correspond with the maximum of magnetic disturbances, and both to correspond with the maximum and minimum of sun-spots and solar coronæ. It would thus seem safe to ascribe a common origin—and that a magnetic one—to all three phenomena.

The resemblance between certain forms of the Aurora and an electric discharge in a chamber of rarefied air is very striking, and the electrical theory which seems to deserve most adherence is that of Prof. Edlund, of Stockholm. He refers it to *unipolar induction*.

The globe is regarded as a rotating magnet, with a good

conducting envelope, *viz.*, the crust. The atmosphere, in its lower parts a bad, but above a good, conductor, becomes a final link of connection of the circuit between the equator and the poles. The positive electricity at the equator will be ejected from the earth, and the upper atmosphere gradually becomes charged with positive electricity, whilst the earth remains negative. The positive electricity moves from equator to poles, while negative electricity moves from poles to equator, and an electric tension is created between atmosphere and earth; and when this becomes too great, a fusion takes place. At the equator and in temperate zones this is effected by sudden discharges or thunder-storms, while at the poles it is more even and continuous, and appears as the Aurora. The discharge occurs most easily in the direction of the inclination-needle, which at the equator is parallel to earth's surface, so that the discharge can only take place when the tension is so great that it conquers the small conductive force of the lower atmosphere. The nearer the poles the more the needle inclines, and so the discharge is easy and even and continuous. Prof. Edlund also shows that these discharges must preferably take place in a belt at some distance from the pole, *i. e.*, in what has been mentioned as the maximal zone.

Mr. Newman described and showed diagrams of meteorological occurrences observed at Reigate on three different occasions. They were long, thin, white bands, apparently of cirrus cloud stretching right across the sky, and on two occasions distinctly converging at their opposite poles. On March 28th, 1885, at 11 p.m., there were three great belts of light stretching in parallel lines across the sky from N.E. to S.W.; wind N.E. The moon shone through one belt, and appeared as in a haze; there was no halo. The weather, both before and after, was fine and settled. This occurrence is already recorded in our Proceedings. On May 15th, 1886, at 11 p.m., there were seen five belts converging in the N.W. and S.E. horizons; wind W.N.W. There was a very distinct lunar halo, of which one belt formed a part. The moon, which was not behind a belt, was blurred and misty. On

November 8th, 1886, at 6 p.m., there were seen eight belts converging in the N.N.W. and S.S.E. horizons; wind S. There was a lunar halo later in the evening, after the belts had disappeared.

In all cases the belts followed the direction, or nearly the direction, of the wind, and thus might well be said to lie along the isobars. Weather varied in the different cases; the barometer and the wind also varied. Temperature, however, showed similar conditions on each of the three occasions, *viz.*, a steady daily maximum, with a grass minimum regularly and rapidly decreasing. Each occurrence also took place between two and three days before full moon. The lunar halo observed on two of the three dates appears to have had no connection with the phenomenon of the belts.

These belts are described by Tromholt as "Polar bands"; they occur at periods corresponding with the Auroral maxima, and are, he says, by many attributed to the same cause. Mr. Whipple, chief of the Kew Observatory, however, does not admit their having any magnetic connections: he describes them as "cirrofilum" clouds, or thread-cirrus, and says:—"The phenomenon is not uncommon during unsettled weather. The converging appearance of the lines is simply due to perspective, as the clouds themselves lie in parallel lines along the isobars. They have no perceptible magnetic effect: however, I have had the magnetograph-curves for all three dates submitted to my inspection, and find that in no case did they indicate any movement of the needles. The cirrus-cloud, which forms the 'Noah's Ark' cloud, being a mass of ice-crystals, when sufficiently attenuated usually forms halos, as you observed in two cases."

It would seem that the first of the three occurrences differed in some respects from the two others, *viz.*, that it did not occur in unsettled weather, and that the belts were not noted as converging at the poles.

Dr. Bossey then gave a demonstration, with the microscope, "On the Structure of certain Ferns."

EVENING MEETING.—DECEMBER 16TH, 1886.

Mr. Brooks exhibited on the screen, by aid of the oxy-hydrogen lime-light, a series of photo-micrographs as lantern-slides. These were Natural History subjects, and were explained by the President, Dr. F. Bossey, and Mr. F. G. Carey. Besides the Natural History slides there were a few of general subjects.

EVENING MEETING.—JANUARY 21ST, 1887.

Dr. Bossey exhibited an Elm root, 1 inch in circumference, much compressed and distorted, found embedded among chalk-pebbles. He also showed a section in which it was clearly seen that the ducts were still sound, in spite of the great compression. He called attention to a museum-specimen also of the Elm, and much larger, which had been embedded in chalk-flints.

The President then read his Annual Report, entitled 'METEOROLOGY, OXFORD ROAD, REDHILL, 1886.'

BAROMETER.—The average height of the barometer for the year was 29·94 in. as observed by me. The maximum as noted by me was 30·68 in., and occurred on November 24th. The minimum was 28·47 in., on December 9th. On 178 days the barometer reached 30 in. and upwards; on 184 days, 29 in. and upwards; on 3 days it fell below 29 in. There was a rapid fall from 29·70 in. on October 14th, to 28·81 in. on the 16th; and again from 29·84 in. on December 6th, to 28·47 in. on the 9th.

During the month of January the barometer stood unusually low, the average of the month being only 29·67 in., while the average of the year was 29·94 in. On five days only in that month did it reach 30 in. December also showed a very low average, 29·68 in. rising to 30 in. on six days only. On two days it fell below 29 in. The average of September was highest, being 30·09 in., sinking below 30 in. only on seven days.

THERMOMETER.—January and February were cold months; the average temperature of January was 34.96° , about 2° below the general average. February was colder than January, the average temperature being only 32.78° , nearly 6° below the average of that month. The first half of March was exceedingly cold, the average temperature of the first sixteen days being only 31.14° , or below the freezing-point, and more than 9° below the general average temperature of that part of the month. The average temperature of December was also low, owing to sharp frosts from the 17th to the 21st of the month, and again a very cold night on the 31st. The average temperature of the month was 35.21° , or about $3\frac{3}{4}^{\circ}$ below the general average.

The temperature fell below freezing-point on 24 days in January; 24 in February; 16 in March, that is, from 2nd to 17th inclusive, falling to a minimum of 18° on the 16th; 5 in April; 1 in May; 8 in November; 20 in December: 98 days in all.

In regard to higher temperatures, August was the warmest month; average temperature, 62.09° . July next; average temperature, 61.27° . June and September were much alike; June, 57.82° ; September, 57.98° .

The temperature rose to 70° and upwards, 3 days in May; 12 in June; 12 in July; 18 in August; 5 in September; 3 in October: 53 days in all. It rose to 80° and above, 4 days in July; 2 in August; 1 in September: 7 days in all.

In the order of temperature the months stood thus, compared with the average of ten years:—

Feb. .	32.78°	39.00°	Oct. .	51.44°	53.50°
Jan. .	34.96°	37.00°	May .	52.75°	53.50°
Dec. .	35.21°	39.00°	June .	57.82°	59.50°
March	39.00°	42.00°	Sept..	57.98°	56.50°
Nov. .	42.58°	43.50°	July .	61.27°	62.50°
April .	46.29°	47.50°	Aug. .	62.09°	61.50°

If an ascending line were drawn, showing the *increase* of temperature from the beginning of the year to the height of summer, and a descending line drawn, showing the *decrease*

of temperature from summer to winter, it would be seen that the rise was more gradual than the fall. The lowest temperature may be expected about January 10th, and the maximum about July 25th, continuing until August 10th, a period of seven months; but the decrease in temperature from August 10th to January 10th occurs in only five months. This law of increasing and decreasing temperature is occasioned, I apprehend, partly from prevailing north-easterly winds in the spring, and from the circumstance that the nights in spring are often clear and cold, the radiation of heat being consequently great at night, retarding the advance of temperature. The earth is also less clothed in the spring than in the autumn, and the clothing of the trees with leaves in the autumn tends to retain the night-temperature. Although on a clear summer's day the open heath has a much higher temperature than the copse or the wood, on a clear night the wood has a much higher temperature than the open heath or field, proving that the temperature is much influenced by the earth's clothing. The heat is retained while the leaves are on the trees, but the leaves fall more rapidly in the autumn than they develop in the spring, hence one cause of the more rapid cooling of the earth's surface in the autumn.

RAIN.—At Redhill the total fall of rain in the year was 34·51 in. The average annual amount during the last twenty years, as recorded by me, is 31·28 in. 1886 may therefore be regarded as a wet year. More rain falls at Redhill than at Greenwich, where the average annual fall is about 26½ in.

Rain fell on 174 days. During the last twenty years, the year in which the least number of days occurred on which rain fell was 1870, 130 days. The greatest number of days was in 1872, 215 days. The average of twenty years gives 178 days. The amount of rain in the year does not, however, always correspond with the number of days on which rain may have fallen, although the amount has some relation to the number of wet days. The smallest *quantity* of rain which fell in any year during the last twenty years was in 1884, when only 23·03 in. fell on 168 days. The largest quantity was in 1877, when rain fell on 203 days to the extent of 39·07 in., but in 1883 rain fell on 201 days to the extent of only 29·81 in.

In the order of amount which fell each month in the past year, May stood at the head, a most unusual occurrence, for May on the average is the second driest month in the year, March being the one in which the least rain falls.

The following table shows the rainfall in the order of amount for each month in 1886:—

	RAIN, REDHILL, 1886.	AVERAGE, REDHILL, 20 YEARS.	AVERAGE, GREENWICH, 10 YEARS.
	In.	In.	In.
May . .	4·66	2·04	1·78
December .	4·63	3·05	2·07
January .	4·56	3·12	2·14
November .	4·07	3·06	2·38
October .	3·95	3·47	2·94
July . .	3·35	2·57	2·63
September.	2·28	3·07	2·43
March . .	2·00	1·82	1·24
April . .	1·80	2·06	2·12
August . .	1·54	2·45	2·69
June . .	1·23	2·13	2·48
February .	0·44	2·36	1·61
	<hr/> 34·51	<hr/> 31·20	<hr/> 26·51

More rain falls at Redhill than at Greenwich. The excess is in the winter half of the year, the total average from October to March being, for Redhill, 16·88 in.; for Greenwich, 12·38 in.; difference, 4·50 in. The total average from April to September being, for Redhill, 14·32 in.; for Greenwich, 14·13 in.; difference, ·19 in.

I observed that for the year 1886 the month of May showed the heaviest fall of rain. There were three heavy falls in that month, *viz.*, on the 12th, 1·17 in.; on 21st and 22nd, 1·44 in.; on 24th, ·91 in.; 3·52 in. in four days. The fall of rain on May 12th was very excessive in many parts of England and Ireland. Over the East of Ireland rain to the extent of 3 in. fell. In several places, in counties Down, Dublin, Meath and Wexford, and in the Isle of Man, 3½ in. fell.

In the Midland Counties of England rain commenced about

noon on Tuesday, May 11th, and continued in some places without intermission from 60 to 70 hours. The heaviest fall was in Shropshire, where during three days more than 6 in. fell. At Burwarton more than 7 in. fell, and at Church Stretton, 4·12 in. on the 13th.

The amount of rain varied much, according to whether the localities were favourable to the deposit of rain or not. In Scotland very little fell, the greatest fall, on the 12th, being at Nairn, and the amount only ·29 in.

The heavy rain caused great floods, especially in the valley of the Severn. In the Severn the flood rose higher than at any period since 1770. In that year the flood occurred in November, and was $2\frac{1}{2}$ in. higher than the one of last May. The flood of May was not only high, but the water rose rapidly, and continued for several days. In Worcester the flood had the effect of depriving the inhabitants of their usual supply of water. They suffered scarcity in the presence of superabundance. The flood invaded the premises of the Water Company, and put out the fires used for the steam-engines which worked the pumps giving the water-supply to the town.

At Sheffield many mills were stopped by the flood reaching the furnaces and workshops, and between 700 and 800 men were thrown out of employment for several days.

As to the height of the flood in some places, the following record is worthy of attention :—At Worcester the water rose 17 ft. 10 in. above the summer-level; at Ross, on the Wye, 14 ft. 3 in.; at Gloucester, 22 ft. 3 in.; at Nottingham, 12 ft. 6 in.

With regard to rain, Mr. Arthur W. Clayden, of Bath College, has made investigation, as reported in the ‘*Meteorological Magazine*,’ as to the thickness of clouds, and the influence the thickness has upon rain-drops and hail. He estimates the thickness of clouds at from 600 to 10,000 ft., and states that in proportion to the thickness of rain-clouds is the size of the rain-drops. Thus, when the thickness of a cloud is under 2000 ft., either no rain falls or the drops are very small. With a thickness of 3000 ft. the rain-drops are

of medium size. At 5000 ft. they are large and cold; at 6000 to 8000 ft. hail may be expected; and at 10,000 ft. heavy and hard-frozen hail.

SNOW.—Snow fell in January on nine days. In February there was only one very slight shower, on the 28th. In March, snow fell on the 5th, 6th, and 15th. The next snow fell on December 17th, equal to about $\frac{1}{2}$ in. of rain. A very heavy fall occurred on December 26th, about $9\frac{1}{2}$ in., in some places nearly 12 in. The snow was of an exceedingly wet and heavy nature, in amount equal to about 1.73 in. of rain; but it is difficult to measure with precision the exact amount of water contained in a fall of snow. The great weight of the snow resting on telegraph-wires and on trees caused an immense amount of damage. Telegraph-wires were broken in all directions over a very extensive district, and the posts which carried the wires were in many cases snapped short off. The snow lay on the ground to the end of the year, and was supplemented by a fall of about 6 in. on January 3rd and 4th, but the record of this properly belongs to the year 1887.

The storm of December 26th, which in our own district was represented by a heavy fall of snow, was in other districts represented by rain. At Torquay nearly 2 in. of rain fell; at Ryde no snow fell, but heavy rain. At Brighton there was no snow, and below Ashford the storm was expended in rain. In most districts where snow fell the storm began with rain, indicating by its change into snow a sudden and considerable fall in the temperature.

I have endeavoured to estimate the weight of snow which rested on the telegraph-wires, and conclude that the weight of snow on each wire from post to post would be about 13 pounds; and as there are not unfrequently 20 wires on one post, this would give a total weight of snow equal to 260 pounds, besides the weight of the wires themselves, very considerably more. It is therefore not a matter for surprise that this additional weight, with a strong wind blowing, should have broken the wires, and have snapped the posts themselves. If the snow had been dry under the influence of severe frost, it would have been blown off the wires like dust.

Much damage was also done to trees, especially evergreens, by the snow breaking off branches, and in many cases splitting the trunks of small trees and shrubs.

Snow and hail are not so dissimilar in their origin as may at first sight be regarded. Snow sometimes falls in very small pellets of precisely like character with that which occasionally presents itself in hail, only the hail is in larger balls. In such case the hail and snow are accretions of frozen vapour having a spongy texture, but at other times hail comes down in hard lumps of ice, the hardness probably arising from the spongy balls being first partially thawed, and the particles in consequence uniting more closely, and then, from their passing through a cooler atmosphere, being frozen hard.

THUNDER AND LIGHTNING. — A thunder-storm occurred on May 22nd, accompanied with a heavy fall of rain, .97 in. The storm lasted from 2 a.m. to 4 a.m. Thunder was again heard on the night of the 22nd or early on the morning of the 23rd. Another thunder-shower occurred on May 31st, about 9 a.m. A storm burst over the district on the morning of September 4th, interfering greatly with one of the excursions of the Club, planned for that day; but the weather cleared up afterwards, and became fine and hot. Those of the members who braved the morning were recompensed by a most delightful excursion to Ashdown Forest, over a charming district.

There was a remarkably heavy thunder-storm on Oct. 19th, very heavy in the western part of the county, but it did not reach Redhill; only lightning was seen. In the neighbourhood of Farnham the storm was so great that many persons were terrified, and one woman, I am told, died from the effects of fright.

HAIL.—Few hail-storms occurred at Redhill. There was a heavy hail-storm in Cornwall and Devon on March 31st, and hail-stones as large as an egg were reported to have fallen, but what kind or size of egg does not appear. The storm was remarkable for the rapid rate at which it travelled across the country, about sixty miles an hour.

WIND.—There were gales on January 16th and March 29th and 30th. Fresh breezes from May 25th to 27th. Strong N.E. winds from October 22nd to 24th, amounting to a gale on the 23rd. A very heavy gale occurred on December 7th, which continued on the 8th.

THE ATMOSPHERE.—Fog prevailed from November 22nd to 27th, but at Redhill the year has not been remarkable for fog.

Brilliant days occurred on March 7th and 8th, and on September 11th and 13th. The air on September 11th was unusually clear, and some of the distant hills occasionally seen from Reigate Hill were distinctly visible on that day. The high land at Stanmore, in Middlesex, and Hampstead and Highgate were seen; also the high land in Epping Forest near High Beech, and the Langdon Hills, in Essex. The Langdon Hills are opposite Gravesend, and are about eight miles from the Thames.

On Wednesday, July 28th, about 6 p.m., being at Windermere, I observed a solar prismatic halo, extending about 30° from the sun, that is, having a diameter of about 60° . There was an exceedingly heavy bank of clouds over the mountains to the west. The phenomenon was followed on the next day by a heavy and unceasing downpour of rain.

Mr. Newman called attention to the long period of persistent low temperature throughout the great part of the year, only relieved by three weeks of fine, warm, sunny weather, beginning in the latter part of August, and again by a week of unusually high temperature in early October. He also spoke of the diverse records of rainfall-gauges in one neighbourhood, all apparently accurate, and without local circumstances to account for the difference, his own record being about 2 in. less than that of Mr. Tyndall; and he alluded to the heavy snowfall of December 26th, stating that on Hindhead he had seen roads blocked from 18 in. to 4 ft. deep for many miles, which drifts had been cut through by degrees. One drift at Windy Gap, near the Cross, was 12 ft. in height, and hollow paths of unknown depth were filled level with the surrounding Common, and indistinguishable from it. Old inhabitants stated that it was the greatest fall within their

memory. Owing to the furious N.E. gale which raged at the time, no fair measurement could be taken of average depth; in places the ground was swept bare, and very little damage was done. At Reigate and in sheltered places much damage was done by the extreme density and consequently great weight of the snow.

Mr. W. H. Beeby read a paper 'ON SOME ADDITIONS TO THE FLORA OF SURREY, 1886.' The new plants for Surrey found by Mr. Beeby during 1886 are *Potamogeton zosterifolius*, and one of the *Characeæ*, viz., *Tolypella intricata*.

The portion of the county specially searched is the part of the Bourne Brook Basin lying between Egham and Chertsey. In this fen-tract *Sium latifolium* and *Utricularia vulgaris* were found, as well as *Rumex maximus*, *Carex intermedia*, *Hottonia*, *Hydrocharis*, *Ænanthe* *Phellandrium*, *Callitriche obtusangula*, and *Lemna gibba*.

Near Witley, the Rev. E. S. Marshall has found *Orobanche Pieridis*; and Mr. H. T. Mennell has found *Pyrola minor* and *Carex strigosa* in the neighbourhood of Oxted.

Mr. Beeby exhibited specimens of all the species recorded.

EVENING MEETING.—FEBRUARY 18TH, 1887.

The attendance of young persons was especially invited, and between fifty and sixty in all were present.

Mr. Arthur C. Sterry, who illustrated his remarks with many beautiful diagrams and with living specimens, gave an address on 'THE LIFE AND HABITS OF CRABS,' of which the following is an abstract:—

The Shore or Green Crab is probably the first to attract our attention as it scrambles over the sand at low tide towards the sea, but in any of the clear rock pools, such as one finds on the Cornish coast, one can readily see the three chief representatives of the Stalk-eyed Crustacea. If a piece of mussel or limpet be held in the pool, very quickly the Prawns, with extended and fan-shaped tails like the Lobster's, will

appear and take it from our fingers, or crawl over them in search of more. If a piece be dropped to the bottom of the pool, the Green Crabs and Hermit Crabs will soon be fighting for it. The former represent the tribe which we usually call Crabs having their tails turned under them, and the latter those with soft tails, which they protect by thrusting them into empty shells, such as the Whelk or Periwinkle.

The aquarium is, however, the best place to study some of their habits, and the Green Crabs, who are as full of fun as Monkeys, are very easily kept. The Hermit Crabs also live well in an aquarium, and are very amusing. He is said to have had formerly a hard, shelly tail, like a Lobster, which has degenerated by being always thrust into a shell. However this may be, he behaves as though he were ashamed of it, and yet he can be made to show it almost as often as we like. If an empty Whelk-shell is dropped into the aquarium, he will examine it inside and out, turn it round and round the right way to let out the air, then placing his legs on the mouth of each shell, he vaults from one into the other so quickly that one can hardly catch a glimpse of his tail.

The common Hermit Crab has very often a worm living with him in his shell, who shares all his food, sometimes even snatching it out of his mouth. Another kind has nearly always an Anemone fixed to the outside of his shell. It is easy to see the advantage which the worm and Anemone derive from this companionship, but not why the Crab allows it, unless he is naturally sociable and likes company. One Hermit in my aquarium was very well-behaved for some months, until one day I gave to an Anemone (the only other occupant of the aquarium) a piece of meat, without giving any to him. As soon as he discovered this he tried to pull it away, but, not succeeding, he pinched and scratched the Anemone till I gave him a piece of meat also. From that time he took every opportunity of annoying the Anemone, which crawled to the top of the water to get out of his way. He tried to reach him by climbing on a piece of pumice-stone floating in the aquarium, but, failing generally in this, he pushed the pumice-stone so as to jam the Anemone between

it and the glass. We rapped his knuckles whenever we saw him, but directly we sat down to a meal we heard bump, bump against the glass, and he was at it again.

The life-history of Crabs is very curious; the eggs are carried about attached to the swimmerets under the body, as is well known in the Lobster. The young vary somewhat, according to the species, but the Green Crab may be taken as a fair specimen. They were known for many years under the name of *Zœa*, before one had any idea that they were the young of Crabs, so little do they resemble the adult form. When first hatched, they have sessile eyes, long tails, and no claws. At the first moult they have claws, stalked eyes, and shorter tail; at the second the tail is turned under, and at the third it is a perfect Crab, with the stalked eyes set in sockets, within which they can be turned back, and are then fitted for their rough life amongst the rocks. From time to time they continue to throw off their shells, as they become too small for the body inside, the skin of which soon after hardens, and becomes a new shell. When any of their limbs are injured or broken off, they would bleed to death if they had not the extraordinary power of breaking off their limbs near the first joint, which rapidly heals over, and a new limb appears as a bud; within this a perfect limb is formed, which is liberated at the next casting of the shell, but is generally smaller than the other limbs. The age to which Crabs and Lobsters live is unknown, but they are often found with very old barnacles attached, which shows that it is some years since they last changed their shells.

One of the most curious Crabs is the Pea Crab, which lives in Mussels and other bivalves, and is so named from its round form. This was a wonder to the ancients, and Aristotle and Pliny relate some curious tales about them. The young probably enter the shell as *Zœa*, and the females never go out again. Their bodies are soft, and they certainly would be killed if nipped by the mussel whilst attempting to get out; but the males have very hard and strong shells, and legs covered with hairs, which enable them to swim well, and they go in and out of the Mussels frequently.

I saw one of the latter, whilst swimming in my aquarium, drop right into the centre of an Anemone (*Actinia mesembryanthemum*), which immediately closed over him. I expected he was killed, and was surprised after a short time to see the Anemone opening again. The Crab lay as if dead till the Anemone was quite open, then suddenly tried to swim out; but the Anemone was too sharp for him, and he was enclosed again. This occurred several times, but at last the Crab lay perfectly still till the Anemone turned him quite out. Thinking that he was very much wanting to enter a Mussel, I procured one next day, and had the pleasure of observing his method of entering. He swam over the Mussel, then dropped on to the portion of the Mussel protruding from the shell, and lay as if dead. He then crawled towards the opening, but so slowly that his movement was imperceptible. When near the opening, he made a start forward, but the Mussel closed on him, and squirted him across the aquarium, as a boy squirts a cherry-stone from between his fingers. After several attempts in this way, which, as far as I recollect, occupied about two hours, he succeeded in getting in.

Amongst the Sessile-eyed Crustacea are some of the most grotesque forms in creation. The Caprellas throw themselves into the most extraordinary attitudes, which are even more curious and laughable than those of the Praying Mantis. Some of this order are very careful of their young. One Caprella carries her young on her back, and the *Gammarus locusta* swims about surrounded by her young, who take refuge under her body like chickens under a hen when in danger.

The eyes of the Crustacea are compound, and resemble those of insects; and they vary in form and perfectness according to the use they make of them. Thus the eye of the common Edible Crab has 3000 facets, and that of the Green Crab only 100. The *Calianassa*, which burrows in the sand, has only small eyes on the sides of the eye-stalks; and the eye of the *Calocaris*, which burrows in the mud often 180 fathoms under the sea, has no colouring-pigment, and no cornea; and one small Crustacean, which lives in deep wells, has no eye at all, but by careful dissection a spot is found under-

neath, showing where the eye should be. The corneal facets are often convex, either externally or internally, but in some species the external and internal surfaces are parallel; and it has been a mystery how an optical image could be formed in such eyes. This has been cleared up lately by the construction of some cylinders of glass, &c., which were shown at the meeting of the Royal Microscopical Society last month. These were made varying in density from the exterior towards the centre, and formed perfect optical images without having the form of a lens.

On the shells of the Pea Crabs may be found *Lepralia*, Bell-animalculæ, &c., which feed on still smaller animalculæ, so that there is life within life without end; in fact, there is no limit to the wonderful works of God; and it is because we find such pleasure in studying these that we invite the young on these annual occasions, hoping that some of them may be induced to study some of the many wonders of Nature, which will be a continual source of pleasure to them throughout their lives.

Mr. J. B. Crosfield gave a short address on the subject of 'SEA-BIRDS AND THEIR HOMES.' He gave some description of the breeding-station on the Island of Handa, off the coast of Sutherland, referring in some detail to several of the species that frequent that and other stations, including the Guillemot, Razorbill, Puffin, Cormorant, Shag, and several Gulls, &c. He also gave some account of the Bass Rock and its immense colony of Gannets; and of the Farne Islands, and some of the species of special interest that are met with there, among which are included the Eider Duck, Sandwich Tern, and perhaps still the Roseate Tern. He mentioned having seen a single King Drake in company with Eiders, on the occasion of a visit to the islands in 1882. He exhibited a series of photographs illustrating the Ornithology of the Bass Rock and Farne Islands, and also specimens of the eggs of many species of sea-birds.

EVENING MEETING.—MARCH 18TH, 1887.

The following donations to the Library were received, and thanks were voted to the donors:—‘*Equisetum litorale* as a British Plant,’ presented by Mr. W. H. Beeby; ‘Proceedings of the Entomological Society of London’ for the years 1884, 1885, and 1886, presented by the Society.

Dr. Bossey exhibited a specimen of pyramidal form, and consisting entirely of corky tissue, believed to be *Xanthoxylon*.

Mr. Albert J. Crosfield read a paper on ‘BIRDS OBSERVED IN DECEMBER, 1886, AND JANUARY, 1887, IN BOMBAY AND THE CENTRAL PROVINCES OF INDIA’:—

It was dark when we landed in Bombay on November 30th, so our acquaintance with the birds of India did not begin till December 1st. The sun had not risen when the Crows began to compete with one another for an early introduction. Let it be said of them that they remained faithful friends to the last moment of our stay in India. During the hours of daylight they were rarely, if ever, out of sight.

Both in Bombay and the Central Provinces two kinds of Crows are about equally abundant. Slightly the larger of the two is the jet-black Indian Corby (*Corvus culminatus*), not distinguishable to common observation from our Carrion Crow. The other bird is the Common Indian Crow (*Corvus splendens*), a bird with grey shoulders and sides, otherwise black. Both species were in the Banyans close to our hotel-windows, and seemed determined that we should not sleep after the first streaks of daylight had lighted the eastern horizon. These Crows seem ever on the watch around the houses, both in city and village, for any fragments of food that may be thrown out to them, nor are they above thieving, if they see a likely chance. Lizards and Chameleons are said to suffer cruel treatment at their hands, or rather beaks. One day, as I sat writing in my bed-room, a Grey-necked Crow came in at the dressing-room window, sat on the edge of the wash-hand basin, and sipped the water. They are said to destroy eggs and insects, and they also eat the Banyan figs. I have seen one settle on a wretched pony's back, and peck at

a sore, returning more than once to the charge, to the evident discomfort of the pony.

Probably the most abundant bird in India, as in England, is the House Sparrow. Sparrows are bold enough with us, but the Indian Sparrows are yet more venturesome, flying in at open doors or windows, and hopping familiarly about the drawing-rooms, even venturing within a yard of your feet. They seem to think the ceiling-cloths specially placed for their convenience, so they pick holes round the punkah-hooks and skirmish through the upper regions in search of grubs or cocoons, even choosing sometimes to nest out of sight between the ceiling-cloths and the thatch. The cock Indian Sparrow (*Passer Indicus*) has an ash-coloured crown, like our bird's, and many close scrutinies failed to show me any difference in plumage, except a greater brightness and cleanness. The authorities, however, have detected some slight distinctions, and have decided that it is a separate species.

Overhead, when I looked out in the early morning from the hotel-windows in Bombay, Kites and Swifts were circling. The common Pariah Kite (*Milvus Govinda*) makes itself useful as a scavenger in every town and village, aiding the Vultures, Jackals, and Crows. Instances are not scarce in which Kites have swooped down and carried off meat from a basket on the cook's head, or have deprived an unwary traveller of a chicken he had just sat down intending to lunch upon in the open air. At Sohagpur, men sometimes catch a Kite by placing a chicken within arm's length of them as they sit with their back to the sun. Anon the shadow of a Kite appears, and as the bird swoops at the chicken, the native, warned by the approaching shadow, seizes the Kite and takes him captive. The cry of the Kite is described by Jerdon as a "prolonged, tremulous squeal." It is not unlike the neigh of a horse.

Two sorts of Swift are seen in Bombay. The Indian Swift (*Cypselus affinis*) is a brown-black bird, with white rump, chin, and throat. It is smaller than our Swift. The other is the little Palm Swift (*Cypselus bataviensis*), a smaller bird

than our Swallow. These Palm Swifts skim over the surface of the maidan. Jerdon describes them as abundant in all parts of India where Palmyra and Cocoa-nut Palms grow. Their nests are always placed on the leaf of the Palmyra (*Borassus flabelliformis*), and are made of the thickened mucus from the bird's salivary glands, mixed now and then with feathers, or bits of grass, or the down of some seed. Occasionally twenty or thirty pairs build their nests in one tree. Some old nests of the Indian Swift I afterwards saw under a ledge of rock near Hoshungabad, built against the rock as Martins place their nests, but made of feathers, which must have been glued together with mucus.

On the telegraph-wires of the Bombay and Baroda Railway rows of exquisite Bee-eaters (*Merops viridis*) were seated, watching for flies and butterflies, after which, anon, one of them would dart. Their rich, green backs and breasts and coppery heads excel in brilliancy the European Bee-eater's. At Hoshungabad, Itarsi, and Sohagpur, in the Central Provinces, as well as all along the Great Indian Peninsular Railway, Bee-eaters abounded. Their note is a not unmusical, querulous whistle. An Indian landscape is scarcely complete without these bright birds, whose slender build and long tail-feathers give them an unusual grace. Jerdon says that they breed in holes in banks of ravines, or rivers, or on road-sides.

Amongst the Bee-eaters I saw my first Drongo Shrike (*Dicrurus macrocercus*), a glossy, black bird, with the actions of a Flycatcher, the flight of the Swallow-tribe, and the habits of the Shrikes, to which it is nearly allied. No one having once seen a Drongo Shrike will easily mistake it again. In size it exceeds a Starling, but its shape is utterly different. The long, deeply-forked tail gives it a character of its own. The popular name for the Drongo Shrike is "King-crow," so-called from its habit of chasing and bullying the Crows. Though the Crows are much bigger than the Drongo, it will drive them about, and give them no rest till they leave it master of the field. A very common perch for the King-crow is the back of a Buffalo or Pony, from which post it will dart after any winged insect that may be passing. Its screech is agreeable rather from association than from musical qualities.

The Vultures of Bombay congregate in the forenoon on Malabar Hill, where are the Towers of Silence to which the Parsees carry their dead. On one of the five Towers of Silence I counted twenty-four Vultures, and many more perched on trees around. At Sohagpur, in the Central Provinces, I counted sixty-nine Vultures in sight at one time, and twelve more rose from behind bushes. These had congregated around a rough valley where the Mohamedans slaughter cattle. An Adjutant or Gigantic Stork (*Leptoptilos argala*) was amongst them. The most abundant kinds of brown Vulture in Central India are the White-backed Vulture (*Gyps bengalensis*), and the Long-billed Brown Vulture (*Gyps Indicus*). When soaring overhead, a Vulture is a splendid bird, with majestic spread of wing; when perching on a tree-top, it is an innate, repulsive-looking fowl; when gorging on a dead donkey, as I saw Vultures doing at Hoshungabad, it is loathsome. The White Scavenger Vulture (*Neophron percnopterus*) is an abundant bird, to be seen in pairs around every village and town in Central India, in company with the Kites. It is a dwarf as compared with the Brown Vultures. On the ground it has an awkward waddle, and is far from being an attractive bird when seen at close quarters; but when soaring aloft amongst the Kites, it is a very graceful object.

In the beautifully-kept flower-garden surrounding the Towers of Silence the handsomest shrub in bloom in December was a scarlet *Hibiscus*, with flowers five inches across. Into the recesses of these splendid blossoms a tiny Purple Honey-sucker (*Arachnechthra asiatica*) was thrusting its slender, curved bill. Most nearly allied of Indian birds to the Humming-birds, these delicate little Honey-suckers may be seen in nearly every flower-garden, and their cheerful little chirp heard. Plumage varies much with age and season. Some birds are glossy, dark purple, almost black, all over; others are pearly-grey on the head and back, have brown wings, and are white below, tinged with yellow; others have a dark-purple streak down the breast, and blue markings on the sides.

As you go about Bombay you now and then hear the scream of a Parrot, and looking up you will see a party of five or six Rose-ringed Parrakeets (*Palaeornis torquatus*) dashing through the air with rapid strokes of their long, green, sharp wings. These Parrakeets and their congeners, the Rose-headed Parrakeet (*Palaeornis rosa*) are found in flocks throughout the Central Provinces. They may be seen feeding in the Tamarind and Peepul trees; they are very destructive to fruit, such as Pomegranates and Guavas; they also plunder fields of corn and of tilly.

An account of the common birds of Bombay and Central India would be very incomplete if it left out the Myna (*Acridotheres tristis*); and a very undeserved slight would be paid to that prim, confiding bird. The Myna is a trifle larger than the Starling. Its general hue is a snuff-brown, the head is black, and white bands on wings and tail render it conspicuous as it flies, whilst its yellow bill, orbits, and legs give it an aristocratic air, in keeping with its neat attire. In Bombay the Mynas walk about the maidan and open spaces. Throughout Central India they come close to the bungalows, often perching on the roof and indulging in not very tuneful music. They may frequently be seen following the cattle, or perching on their backs in pursuit of insects.

A somewhat smaller and less common bird is the Bank Myna (*Acridotheres ginginianus*), readily distinguished by its red bill and white cheeks. I saw it both at Hoshungabad and Sohagpur. At the latter place it was feeding amongst the butchers' leavings, probably finding maggots or beetles.

Another species of bird common both in Bombay and the Central Provinces is the Black-faced Wagtail (*Motacilla dukhunensis*), the Indian representative of the White Wagtail, which it resembles very closely both in plumage and habits. The Indian Field Wagtail (*Budytes viridis*) is also abundant during the cold season, often feeding amongst cattle. According to age, its plumage is greenish or grey above, and tinged with yellow below.

In Bombay I first heard the "wheet-wheet-wheet" of the Tailor-bird (*Orthotomus longicaudus*), an engaging though plain

little warbler, having a rufous head, olive-green back, and white breast. From its habit of cocking up its tail as it steals about a hedge or shrub, it reminds one of our Wren. The skill of the Tailor-bird has often been described. Jerdon says:—"The Tailor-bird makes its nest with cotton, wool, and various other soft materials, sometimes also lined with hair, and draws together one leaf or more, generally two leaves, on each side of the nest, and stitches them together with cotton, either woven by itself, or cotton-thread picked up; and after passing the thread through the leaf, it makes a knot at the end to fix it." I saw the Tailor-bird again at Sohagpur and Bandri, in the Central Provinces.

When morning dawned on December 4th, it found us travelling eastward from Bombay along the Great Indian Peninsular Railway. We had crossed the Ghats in the night, and were passing through cultivated country amongst fields of Cotton, Grass, Dal, Flax, and Wheat. From almost every field the Little Brown Dove (*Turtur Cambayensis*) rose in ones, twos, sixes, twelves, or twenties. The Common Ring Dove (*Turtur risoria*) was almost as common. It is a grey-brown bird, with a narrow, black ring or collar, like that of the domestic Turtle Doves that we so often see in cages. Both birds used to come daily into the garden at Hoshungabad. A pair of the Little Brown Doves usually spent the day on a piece of matting at the bottom of the garden, whence their soft coo was to be heard at all hours.

From the train we first made our acquaintance with that gloriously-tinted bird, the Indian Roller (*Coracias indica*), popularly called the "Blue Jay." When perching, the Roller has a singularly senseless look. Its flat head suggests want of brain. It draws its short neck down on to its shoulders, puffing out the feathers of its head and neck, and gives you the idea of stupidity. But when the Roller spreads its gorgeous wings, and displays a fine series of blue shades from pale sky-blue to deep violet, you are lost in wonder at the transformation.

For brilliancy of plumage few birds excel the Indian Oriole (*Oriolus kundoo*), which I caught sight of at times, both

at Hoshungabad, in Bombay (where it appeared to be in search of the Banyan Figs), and from the train.

Of Kingfishers three kinds are pretty common. The largest of the three is a black and white bird, the Pied Kingfisher (*Ceryle rudis*). It is abundant on the banks of streams, rivers, and ponds. I saw it repeatedly beside the little river at Sohagpur, and noticed it hover over the stream, plunge overhead into the water, and, reappearing, fly off with its prey. A much brighter-coloured bird is the White-breasted Kingfisher (*Halcyon fuscus*), with a bright cerulean-blue back, a chocolate head and sides, and a white throat and breast. Its large, coral-red bill and vermilion feet give another touch of brilliancy to this handsome Kingfisher. In habits it differs from the Pied Kingfisher in being more often seen away from water; it comes into gardens, and may be seen on the telegraph-wires or in forest glades. The third Kingfisher closely resembles our common Kingfisher, but is slightly smaller, and the colours are brighter and clearer. It is called *Alcedo Bengalensis*. One of the delights of a naturalist in India arises from the tameness of birds. On the Thames an old Kingfisher will sight you at a distance of half-a-mile, and be off. At Itarsi I stood within a few yards of the little Bengal Kingfisher as it hovered over a wayside pool and settled on the clay banks, where there was not the slightest cover.

No one can pass many hours at Hoshungabad without becoming acquainted with the Rufous-backed Shrike (*Lanius erythronotus*). From its perch on the topmost twig of some bush or small tree it pours forth its note (song you cannot call it), meanwhile working its tail or whole body up and down with very much the manners of our common Butcher-bird. Now and then it will dart into the air, catch a passing fly, and then fly back to its look-out post to await another. A rather smaller bird, the Bay-backed Shrike (*L. Hardwickii*), is almost as common as the last-named. I only met with one pair of the beautiful Indian Grey Shrike (*L. lakтора*); they were taking short flights from perches upon the upper boughs of some Mangos.

A small bird, the White-browed Fantail (*Leucocerca albo-frontata*), with a good deal the form of the Shrikes, frequents gardens and roadsides at Hoshungabad and Itarsi, and is of very restless habits. I watched one playing strange antics, fluttering up and down a Banana leaf, all the time spreading out its wings and tail. It has a gushing little song, described by Jerdon as "consisting of several notes following one another in a regular descending scale."

The visitor to India cannot fail to see the nests of the Weaver-bird (*Ploceus baya*), which are familiar sights to him before he finds out the builder, a bird in general appearance not unlike our Yellowhammer. From the train I more than once saw six or eight of these nests in one tree, often in an Acacia. At Hirankhera several imperfect nests were hung to the leaves of Palms that grew on the edge of the tank. It will be seen that these nests have no bottom where eggs could possibly lie, but only a perch or swing where the male bird can roost. When the nest is completed, one of the two entrances is closed, and the other is prolonged. It may be doubted if any other bird has so much cunning in proportion to its size. Not only does the Weaver-bird build its nest with such skill, but it is often tamed and taught to perform tricks. Jerdon, quoting Mr. Blyth, says:—"Exhibitors carry them about, we believe, to all parts of the country: and the usual procedure is, when ladies are present, for the bird, on a sign from its master, to take a cardamon or sweetmeat in its bill, and deposit it between a lady's lips, and repeat this offering to every lady present; the bird following the look and gesture of its master. A miniature cannon is then brought, which the bird loads with coarse grains of powder one by one, or more commonly with small balls of powder made up for the purpose; it next seizes and skilfully uses a small ram-rod; and then takes a lighted match from its master, which it applies to the touch-hole. We have seen the little bird apply the match five or six times successively before the powder ignited, which it finally did with a report loud enough to alarm all the Crows in the neighbourhood, while the little Baya remained perched on the gun, apparently quite elated with its performance."

Amongst the birds first caught sight of from the train was the Hoopoe (*Upupa nigripennis*). From its breadth of wing and undulating flight I took it to be a Woodpecker, until I made closer acquaintance with it at Hoshungabad, and later at Sohagpur. The Hoopoe is generally met with in pairs, feeding on the ground, when, with its crest thrown back, it searches diligently for insects. I never heard the Hoopoe make any note or cry.

Amongst the birds that frequent the gardens in Central India are the Magpie-Robin (*Copsychus saularis*) and the Brown-backed Indian Robin (*Thamnobia Cambaiensis*). The former is a favourite cage-bird, and has a pleasing little song. The latter has much the manners of our Hedge-Sparrow, and may often be seen stealing about the bottoms of bushes or hedges, or taking a short flight from one cover to another. The hen is grey-brown all over, except the lower tail-coverts, which are of a rich chestnut-colour. The cock is black on the under parts, and has black wings and tail.

The Indian Redstart is another charming little bird, with a deep-black head and throat, and ruddy breast, under parts, and tail.

At Sohagpur I first met with the Common Madras Bulbul (*Pycnonotus hamorhous*). It is a distinguished-looking bird, the size of a Thrush, with a black face and crest, brown back, greyish breast, white upper tail-coverts, and brilliant-crimson under the tail. It makes a sweet chirp. The Bulbul frequents gardens, and feeds on fruits. I saw one pecking at a Pomegranate. In Delhi, birdcatchers were snaring them on the maidan.

The Bengal Babbler (*Malacocircus terri-color*) is a noisy, plain-brown bird, usually met with in small flocks or family parties, and called by the natives, "*sat bhai*," = seven brothers. Its chatter reminds one of our Starling.

The Rose-coloured Pastor (*Pastor roseus*) occurs in flocks in India in winter, and takes the place of the Starling. Two or three score of these birds were picking the berries off some large bushes in a garden at Agra, keeping up an incessant squeaky chatter. They climbed about the bush like Parrots,

sometimes balancing themselves head-downwards. The young birds are dusky-brown above, and grey below.

The Indian Magpie (*Dendrocitta rufa*) is usually met with in pairs. Its cinnamon and grey plumage is decidedly handsome.

The Coucal (*Centropus rufipennis*), a large bird, popularly called the "Crow-Pheasant," is allied to the Cuckoos. Its booming-call may be heard all day long from the tops of the Palms. It is shaped like a small Pheasant, and is dark purplish-black, with rufous wings.

Amongst British birds to be met with in India during the cold season I may name the Swallow, Sand Martin, Lesser Whitethroat, Quail, Snipe, the Common and Green Sandpipers, the Greenshank, and most of our species of Duck.

A few other birds are really common in the Central Provinces, such as the Spotted Owlet (*Athene Brama*), which ventures out at dusk from its hiding-places around every village; the Munia, a little finch with a white rump; the Indian Titlark; the Short-toed Lark; the Black-bellied and the Rufous-tailed Finch-Larks; the Wire-tailed Swallow; the Dusky Crag Martin and Indian Bank-Martin; the Grey Partridge; and others.

The Crimson-breasted Barbet (*Xantholama Indica*) is a very un-English looking little bird, with a loud call, which has earned for it the name of the "Coppersmith." It came into the Banyans at Solhagpur and fed upon the Figs.

One bird more I must name, one of the most glorious of feathered fowl, with plumage of green and blue, and purple and gold, a sight of which in the wild state is not an everyday occurrence, the Peacock (*Pavo cristatus*). It must indeed be a fine sight to see a party of ten or a dozen Peacocks coming down towards sunset to the river's edge to drink. On two occasions it was my good fortune to catch sight of wild Peacocks in the jungle when travelling by rail in the Central Provinces.

A number of Waders and water-birds that I met with in the neighbourhood of a tank some seventy acres in extent, at Hirankhera, in the Central Provinces, I have described in a

separate paper. I may here just enumerate the species that have not already been mentioned:—The Sarus Crane, Spoon-bill, White Ibis, Cattle Egret (a very abundant bird in India), Pond Heron, Common Heron, Purple Heron, Red-wattled Lapwing (seen almost daily in the Central Provinces), Indian Ringed Plover, Stilt, Black-backed Goose or Comb Duck, Teal, Little Cormorant, and Black-bellied Tern. Never before or since have I enjoyed so rich an ornithological treat.

The paper was illustrated by a number of skins and some nests.

Mr. Crosfield also exhibited dried specimens of various trees and shrubs from India, including Tamarind, Peepul, Banyan, Mango, Pomegranate, &c., and made remarks thereon.

EVENING MEETING.—APRIL 15TH, 1887.

The Proceedings of the Croydon Microscopical and Natural History Club for 1886 were presented by the Club.

Mr. Arthur C. Sterry exhibited Lichens growing in festoons 3 ft. in length, found near San Remo at a height of about 4000 ft. above the sea-level.

Mr. Sterry also showed a plant (*Muehlenbeckia platyclada*) belonging to the order Polygonaceæ.

Mr. A. J. Crosfield brought for exhibition the four parts already published of Lord Lilford's 'Coloured Figures (by Keulemans) of the Birds of the British Islands'; a stuffed Parrot-fish, from Aden; models of the Mango and Papaw fruits; Betel-nuts; Jawari (which is used in place of Oats in India); specimens in spirits of the Cobra, Bis-Cobra, and Kareit Snakes; Garnets from Jeypore; Opals from Mexico; pieces of volcanic rock from Aden; pieces of conglomerate from the Satpura Hills, in Central India; a specimen of rock from Hoshungabad, consisting of clay and iron-pyrites; seeds of Precatoria; Porcupine-quills from Hoshungabad, Central Provinces, India.

Mr. Crosfield remarked that the Porcupine is a night-feeder. During January last a Porcupine rooted up some fine Arums (*Callæ*) in Mr. Williams' garden at Sohagpur.

Mr. Tyndall remarked that Garnets are found chiefly in Hornblende and Mica. They are found in England and Scotland, though not in a very pure state. A form called "grossularia" is found in Russia. Garnets are composed of about forty per cent. of silica, twenty per cent. of alumina, some oxide of iron, and manganese; they are usually twelve-sided crystals. Opals are composed of eighty-five to ninety per cent. of siliceous earth, and five to fifteen per cent. of water; they are not crystalline, and are soft; they are not faceted, but polished with a rounded surface. Some eight varieties are known. The Harlequin-Opal has the colour in spots; some Opals are pale yellow. They are found in South-Eastern Europe, in the Ural district.

Mr. Albert J. Crosfield read some 'NOTES ON WILD FOWL SEEN IN CENTRAL INDIA':—

On the southern side of the village of Hirankhera is a tank about seventy-five acres in extent. On December 30th about half this area was water and the other half mud, more or less baked by the sun. The mud was ploughed into uneven furrows by the Wild Boars, which, we were told, come by night in herds of fifty or more to root up the rushes, on the pithy parts of which they feed. The north-eastern end of the tank is surrounded by a wall of earth to protect the village against a flood. At the western end it floods somewhat indefinitely during the rains, extending out towards cultivated fields on the sides and towards the jungle behind.

On the thrown-up bank are some fine Tamarind trees, then covered with pods, and there is a "Phepar" (*Ficus cordifolia*), under which, on a rough stone, is a rude painting in red of "Hanuman," the monkey-god, distinguished by his long, red tail. A wax-like parasite, not wholly unlike our Dodder, grows freely on the Phepar. Wild Palms are scattered at intervals round the lake, whilst a most graceful group of seven stands on an islet.

In some of the Palms are the nests of the Weaver-bird. A nest, which we hooked down with a forked stick, was hung by its apex from a single leaflet of the Palm-leaf. It is made

of dry grass, and shaped like an extinguisher; it is ten inches in length; at the bottom it measures six inches by four inches. There are two openings at the bottom, each about two inches across, with a bridge of grass between them, which may form a perch for the bird, but could not hold the eggs, as it is only an inch wide. These nests I take to be places of shelter, not places to breed in.

When we approached the tank, probably a hundred birds, of one kind or another, were in sight. Nearest to us, on the rough ground, were several Common Ring-Doves (*Turtur risoria*), of a grey colour, with a black ring on their necks. A rather smaller Dove is spotted with black on the shoulders, and tinged with vinous colour on the breast. There were also a number of Rufous-tailed Finch-Larks with grey backs, and ruddy breasts and tail-coverts. These Larks are inclined to be bullies, and chase the Doves and Bee-eaters about. Along with them was a smaller bird, the Black-bellied Finch-Lark; it is pale brown, with a white forehead and white cheeks, and black lines above and below the cheeks, and black on the throat and breast. The most striking birds in sight were three large Sarus Cranes, which were feeding at the water's edge. They had lavender-grey backs, white necks, black breasts, and bright red on the back and sides of the head, the foreheads being grey; the note may be rendered by the word "grus." Two flocks of large Ducks were resting on the mud-banks. Between them they numbered about fifty birds. Later, I counted sixty-two on the wing at one time. These are the Nukhta or Comb Duck, also known as the Black-backed Goose. Along with the Ducks was a Heron, our English bird. Two Ibises were nearer at hand, wading in the water and thrusting their long, black, curved beaks into the mud. They were white, except for dark grey on their heads. To the left were eighteen Egrets in snowy white plumage. An hour later they had gone to roost in a Tamarind overhanging the water. One of these Cattle Egrets perched on the back of a Bullock. Two Small Pond-Herons were standing in the shallow water. Their backs were brownish grey, and their sides and breasts were streaked

with the same. They had a tinge of green on their foreheads. When they flew, their wings looked grey. They stood with their necks buried in their shoulders. A bird, shaped like a Cormorant (probably the Little Cormorant), and black nearly all over, had a very long, Snake-like neck, and a yellow beak. It had a little grey on the wing. On the edge of the water was a pale brown wader (about the size of a Redshank), with long, yellow legs and black bill. Its head was shaped like a Plover's. When it flew, it showed black tips to its wings, a white band on the wing, and white on the under side of the wings. This was most likely a young Stilt. Several Red-wattled Lapwings, a species the size of our Peewit, and abundant in India, were wading in the pools. About a dozen green Parrots (the Rose-ringed Parrakeet), with long tails, dashed screaming from two Palms by the water-side. Overhead, Wire-tailed Swallows were flying. They are glossy steel-blue above, and pure white below, and have very sharp wings. Old male birds have the outermost tail-feathers prolonged in the form of a thin string or wire. A Kingfisher (*Alcedo Bengalense*) was perched on a rush-stem, and darted down into the water. It was like our English bird, except that it was a trifle smaller, and that the colours were brighter. Black-faced Wagtails and glorious green Bee-eaters were met with at intervals round the tank. Nearly every little pool had its Green Sandpiper. On the margin of one pool was an Indian Ringed Plover with rather more white about its head than our bird has. A ring of white and a ring of black each went right round its neck; its legs were yellow. A small Duck, probably a Teal, rose and flew off over the tank. The Mynas, common everywhere, were chattering in the trees where the Weaver-birds had built. Finally, as we were leaving the tank, a small Owl, probably the Spotted Owlet, settled on the hedge of thorns; and a Nightjar rose from the ground near us, showing a little white on its wings as it flew.

Very few plants grow on the rough ground, but here and there are patches of a plant with pale blue flowers marked on

the lip with yellow streaks. It grows in spiny whorls, on branching stems about a foot in height.

Another hour spent at the "Tank" early the next morning resulted in considerable additions to the previous record. I counted seventy-eight Ducks in sight at once; and in the same pool of water with some of the Ducks a Spoonbill was wading, and turning up the mud with the flattened end of its bill. Next to the Cranes and Herons, it was the largest bird seen. Amongst some reeds not far from the Spoonbill, a Purple Heron was standing. Snipe kept rising, one or two at a time, and often settling most conveniently near to me. Their cry seemed to be the same as our Common Snipe's, and the colouring to be the same; the under parts were rather lighter than in our Snipe. Fifteen Teal rose together; as they flew I could distinguish no colour but grey; one which remained behind had two small white bars on the wing; when flying, the under parts appeared light-coloured, and the under side of the wing looked white. A Yellow-headed Wagtail had the face and breast pale yellow, a little black on the nape of its neck, and a grey back. A most graceful Black-bellied Tern was fishing in the "Tank"; it had the bill and legs orange, silvery wings and back, and a white throat; the crown of the head, the breast, and under parts were black. Some Bunting-like birds, which settled on a hedge, had bright yellow breasts, pale chocolate throats and heads, grey backs, and brownish wings faintly tinged with green; these are the Weaver-birds, whose nests have been already described. One or two Indian Bush-chats were about; they are like our English Stonechat, but smaller, and their rumps are lighter. A little flock of small, brown Finches (*Munias*), with white rumps, were playing about the hedge surrounding a field of cotton near the "Tank."

ANNUAL MEETING.—OCTOBER 21st, 1887.

The Annual Report and Balance Sheet were read and adopted, as follows:—

HOLMESDALE NATURAL HISTORY CLUB.

Annual Report, October 21st, 1887.

Since our last Annual Meeting eleven members and two subscribers have joined the Club; six have resigned, and two have died, leaving a present membership of eighty-one.

The character of the evening meetings was well maintained, though the attendance was not large, excepting at the meeting in February, to which young persons were specially invited; and at the December meeting, when Mr. W. Brooks exhibited on a screen, by aid of the oxy-hydrogen lime-light, a fine series of photo-micrographs of Natural History objects, which were explained by Dr. Bossey and other members. He afterwards showed some striking photographs of Haddon Hall, Canterbury, and other places.

The following papers were read or addresses given at the evening meetings:—

Oct., 1886. 'Report of Excursions,' by Mr. W. H. Tyndall.

'British Reptiles,' by Mr. Benjamin Lomax, F.L.S.

Nov. 'The Aurora Borealis,' by Mr. T. P. Newman.

Jan., 1887. 'Meteorology for 1886,' by Mr. W. H. Tyndall.

'Additions to the Flora of Surrey during 1886,' by Mr. W. H. Beeby.

Feb. 'The Life and Habits of Crabs,' by Mr. A. C. Sterry.

'Sea-birds and their Homes,' by Mr. J. B. Crosfield.

March. 'Birds observed in Bombay and the Central Provinces of India during December, 1886, and January, 1887,' by Mr. A. J. Crosfield.

April. 'Notes on Wild Fowl seen in Central India,' by Mr. A. J. Crosfield.

The Excursions taken during the summer months were as under:—

Whole-day.

May 7. Chilworth, Ewhurst Mill, and Gomshall.

June 15. Edenbridge, Hever Castle, and Chiddingstone.

June 25. Gomshall.

Aug. 20. West Hoathly and Ashdown Forest.

Oct. 1. Gomshall.

Afternoon.

April 23. Betchworth and Reigate Heath.

May 23. Flanchford and River Mole.

July 9. Reigate Hill.

Aug. 6. Norbury Park.

Sept. 3. Worms Heath.

On May 7th, the path from Chilworth towards Ewhurst Mill led through pleasant, sandy lanes to Farley Green, and thence through Pine-woods to Ewhurst Mill. The land was undulating, the valleys in the Pine-woods running north and south. In one of the lanes were observed unusual contortions of the sand-strata, some portions being changed from horizontal to perpendicular. Mr. J. B. Crosfield collected between fifty and sixty different plants in flower. In a bog near Gomshall Station was found the Marsh Orchis.

On Wednesday, June 15th, the Holmesdale party divided into two portions, one leaving Redhill at 10.30, the other about 2.30. The early party walked from Edenbridge Station to Edenbridge, and visited the Church, which is old, some portion Norman, but principally early English. They then took the road to Hever, which gave pleasant views of the range of greensand hills, and occasionally of portions of the North Downs, Toys Hill being conspicuous, having an elevation of over 800 ft.; it is largely covered with wood. Arrived at Hever, they inspected the Church, which possesses some interesting monuments: one of Sir Thos. Boleyn, the father of Queen Anne Boleyn, the date being 1537; a mural tablet of one of the Cobhams, early proprietors of the manor of Hever; the date of the tablet, which is brass, is 1399. After inspecting the Church, the members proceeded to the Castle, which lies lower down in the valley. Two rooms were shown: the ancient ball-room, about 50 ft. long by 16 ft. wide, and the state-room, about 25 ft. long and 16 or 17 ft. wide, neither possessing any special points of interest. The ancient gateway remains with a double wooden portcullis, and one moat, with some remains of a second moat. The greater part of the house is now occupied as a farm-house. The ancient

baronial hall, a very fine room, is now the kitchen. There is a fine old staircase, and some of the rooms on the ground-floor have been converted into very excellent dining and drawing-rooms. The present tenant is a Mr. Heard, who courteously conveyed the members over portions of the inhabited part of the house, and pointed out the path across the fields to Chiddingstone.

Arrived at Chiddingstone, the members who left early were joined by those from Redhill and Reigate, who left in the afternoon, and also by the members of the Tunbridge Wells Society. The Chidding-stone was visited; it lies close to the hotel, and is in fact an outlying part of the Hastings rocks which extend through portions of Kent and Sussex for many miles; it is one of the most northern portions of the rock. Chiddingstone Church was inspected, but there was nothing in connection with it calling for special remark. Some fine specimens were gathered of the Butterfly Orchis. Between fifty and sixty ladies and gentlemen were present, twenty-two of whom came in connection with the Holmesdale Club; the rest were from Tunbridge Wells.

The excursion to Gomshall on June 25th was devoted to the collection of flowers, and a large number were named and exhibited at the Museum in the evening. Two abnormal specimens of the Man Orchis (*Aceras anthropophora*) were gathered; one of these had the lip undivided; in the other the segments of the lip were unusually narrow, and there was a remarkable increase of parts in several of the flowers.

Members of the Tunbridge Wells Natural History and Antiquarian Society joined in the excursion to Reigate Hill on July 9th. Most of the Orchises were over, having lasted but a short time, owing to the drought; a few plants only of the Bee Orchis were still in bloom.

On September 3rd members went by train to Warlingham Station, thence up the steep side of the hill from the Caterham Valley. On arrival at the top, looking west to the opposite side of the valley, rich fields of grass, with timber and park-like grounds were observed. Level table-land was traversed after passing through Warlingham Village, along a road and

country sparsely peopled, to Worms Heath. From the elevated land a distant prospect north, beyond London to high ground in Essex, was obtained; the Crystal Palace was prominent; Reigate Hill and high ground beyond to the north-west, probably about Bagshot, were in view. At Worms Heath, funnel-shaped excavations in the sandy, gravel soil of the Oldhaven beds were noted. The earth from these excavations was thrown up in heaps at the edge of the excavations. It has been suggested that these excavations were habitations of a bye-gone race, but this is doubtful. Near these excavations was a large gravel-pit, with masses of gravel cemented firmly with iron, hard as rock. The gravel was of various colours: some almost blood-red, others with dark, nearly black stains. Sand was mixed with gravel. Returning home through Halleloo Valley, *Fumaria Vaillantii* was found. This valley is one of the principal sources of the Bourne, which flows freely at irregular times down the Caterham Valley, finding its way into the Wandle at Croydon.

October 1st.—Fungus Expedition. Members met at Gomshall Station, twenty in number, and proceeded to the woods on the higher ground, north of the station. Plants of Lady's tresses (*Spiranthes autumnalis*) were found. Fungi were not very abundant, but still a considerable number of species were laid out in the evening in the room of the Club at Reigate; and descriptions of several species were given by Mr. James B. Crosfield, showing the difference in formation by which species may be known. More than 180 species of plants were found in blossom. From the high ground near to the grass road leading to Dorking was a most beautiful prospect, the near view looking into a wooded valley. The distant view embraced Leith Hill, and the sand range westward to Hindhead and Blackdown.

Printed Proceedings for the years 1884 and 1885 were published last autumn.

DONATIONS.—'Proceedings of the Entomological Society of London for 1884, 1885, and 1886'; presented by the Society. A paper on '*Equisetum litorale* as a British Plant,' by Mr.

W. H. Beeby; presented by the author. 'Proceedings of the Croydon Microscopical and Natural History Club' (1886); presented by the Club. 'Report of the British Association for 1886.'

EXHIBITS.—Oct. 15, 1886: a green Dahlia; living specimens of the Ringed Snake, Toad, and Slow-worm. Nov. 19: a branch of Raspberries in fruit; a branch of *Deutsia scabra* bearing both green and red leaves; specimens of a fungus (*Helvella*). Jan. 21, 1887: an Elm-root curiously distorted; specimens of plants recently added to the Surrey Flora. Feb. 18: specimens and diagrams of Crabs; photographs of birds on the Bass Rock and Farne Islands; and a series of sea-birds' eggs. March 18: corky tissue of *Xanthoxylon*; skins of Indian birds, and dried specimens of leaves of trees and shrubs from India. April 15: a silky, bottle-shaped cocoon of Spider from Italy; Lichens in festoons 3 ft. in length. Sundry specimens of minerals, seeds, &c., from India.

The PHOTOGRAPHIC SECTION of the Club was formed in May, 1886, under the presidency of Mr. R. L. Hesketh, with Mr. W. Brooks and Dr. Wheeler as vice-presidents, and a committee of six gentlemen. Since that time indoor meetings have been held, at which papers have been read, with illustrations, on the following subjects:—'Lenses, their Construction and Use,' by Mr. W. Brooks. 'Exposure and Development,' by Dr. Wheeler. 'Enlarging,' by Dr. Wheeler. 'Photographing Interiors,' by Mr. Milner. 'Instantaneous Photography,' by Mr. W. Brooks. 'Bromide-paper Positives,' by Mr. Ferneley. 'Composition as applied to Photography,' by Mr. Sharp. In addition to the above, a very pleasing evening's entertainment was given by Mr. W. Brooks in November last, consisting of a large number of photographic transparencies shown by the lime-light. A number of half- and whole-day excursions to various places of interest in the neighbourhood were arranged for the summer months, but these were not attended with the success that might be desired. The members of the Club deeply regret the heavy loss recently sustained by the death of one of the most prominent members and a vice-president of the photographic

Adelaide is situated about 35° south of the equator, a latitude corresponding to that of Algeria. The area of this colony is $15\frac{1}{2}$ times that of England and Wales, nearly half the colony being within the tropics. From the southern sea-board the rainfall decreases very rapidly as one proceeds towards the centre of the continent. On reaching the tropics, at or near the centre of the colony, the rain begins to increase again until on the northern sea-board, where the shores are washed by the Indian Ocean, a very heavy rainfall is registered. The northern territory is watered by some fine rivers, emptying themselves into the Indian Ocean and the Gulf of Carpentaria. In a large tract of country lying between the centre of this colony and the borders of Western Australia the rainfall may be said to be *nil*. The far interior is, I understand, as a whole, flat, with here and there a ridge of rocky hills or mountains, in some cases almost bare masses of granite. The plains, for reasons stated above, are almost nude of vegetation, a Prickly Porcupine Grass (*Spinifex*) managing to exist where everything else fails. Of course, when there happens to be a sufficient fall of rain, even in parts far in the interior, grass and beautiful flowers spring up only to enjoy a brief existence. From the *Spinifex* country as one progresses south, plains are met with covered with Salt-bush, a succulent plant allied to the Mesembryanthemums, growing to a height of two or three feet; this plant, curiously enough, is good feed for sheep.

Adelaide is situated about five miles from the sea, or rather from the Gulf of St. Vincent, and five miles from the foothills of the Mt. Lofty ranges. Mt. Lofty, the highest of these hills, is about 2300 ft. high. The plain between the hills and the sea is thoroughly under cultivation; the original scattered timber has almost entirely disappeared before the hand of man. The birds on the plains are not numerous, being almost confined to the patches of timber still remaining. This timber is, of course, *Eucalyptus*, and when in flower, which occurs once every two years, is frequented by several species of Honey-eaters, and two species of Honey-Parrots.

Near the coast there is in some places a double ridge of

sand-hillocks covered with a thick growth of native Pine, one of the Cupressi; between these ridges is a swamp more or less covered with a dense growth of Ti tree (*Melaleuca*), one of the *Myrtaceæ*, a sombre bush reaching a height of above ten feet.

In the native Pine Scrub one or two species of the beautiful Ground Parrakeets (*Euphema*) are met with; when disturbed by the intrusion of the sportsman, they fly off in batches, giving forth a peculiar, squeaking cry. Three species of Fan-tail Flycatchers (genus *Rhipidura*), the commonest called the Wagtail by the colonists, and the Large-winged Flycatcher frequent this Pine-scrub. These Flycatchers get an easy living on the Mosquitos which are bred in the swamp near by, but after emerging from the watery element the Mosquitos take up their abode on the hot sand-hills covered with Pine-woods.

The Ti Tree swamp is the home of little insectivorous birds allied to our Warblers, and belonging to the genus *Acanthiza*. These little fellows have most of them a warbling song, often very pretty. Then there are numbers of the beautiful Blue Wrens (*Malurus cyaneus*), also a quiet little song-bird. Owls make the sombre Ti Tree scrub their home. The White-fronted Heron, Nankeen Night-Heron, and a few Ducks live in the swamp itself.

The open, cultivated plain-country is frequented by the Australian Magpie, or Piping Crow-Shrike (*Gymnorhina leuconota*), its beautiful piping notes and droll ways making it one of the favourite Australian pets. In this open country the Common Grass-Parrot (*Psephotus haematonotus*) is in its element.

The hill-country of the Mt. Lofty ranges is very different from the plains in the character of its flora. I forgot, in speaking of the plains, to refer to the gardens and park-lands. The park-lands round the city are half-a-mile wide and many miles in circumference, for the most part planted with Eucalypti and ornamental scrubs. Almost the only inhabitant of these trees is the pretty, green, White-plumed Honey-eater (*Ptilotis penicillatus*). Owing to a lack of its favourite

food, honey, this bird feeds very largely on insects. Another little greenish bird, with a ring of white feathers round its eye, commonly known as the "Silver Eye" (*Zosterops dorsalis*), takes up its abode in the Orange-orchards, vineyards, &c., at certain times of the year, in quite large flocks. They sometimes do much damage to the Grapes, though Mulberries are more to their taste.

The foot-hills of the ranges are, many of them, covered with grass, interspersed with a few Peppermint-Gum trees. On other hills, where the ground is poorer, Heath-like plants of the order *Epacridaceæ*, as well as those of the *Gravillia*, *Tetratheca*, and *Amredia*, and various *Cistus*-like bushes, take the place of the Grass. Scattered here and there are dwarf trees or large bushes of a large-flowering *Eucalyptus*. Earlier in the year, in spring-time, the ground is covered with Orchids of the most varied shapes and colours.

As one follows up the gullies to the higher ranges the vegetation gradually alters. More Pea-shaped, flowering bushes are met with, then Grass-trees, and She-Oaks, until all these give way to the Stringy-Bark, a species of *Eucalyptus* with rough, shaggy bark, like a door-mat. In the upper ranges only is the finest of the *Epacridaceæ*, or Heaths, found; its spikes of tubular flowers varying from pure white to deep crimson, and reaching a height of several feet, are of extreme beauty. The ranges are the home of many kinds of Honey-eaters. The delicate little Spine-billed Honey-eater confines itself to the lower bushes and heaths, whereas the larger Honey-eaters, such as the Myna (*Myzantha garrula*), and the Wattle-bird (*Anthochaera carunculata*), confine themselves to the larger Gums when in flower, and to insects. The Myna is a most noisy bird, inhabiting districts where the timber is large and somewhat scattered. On intruding into their domain one starts the chorus of "thief! thief! thief!" which they all take up, flying into one tree, and there going through all sorts of antics and emitting the above sound with variations.

The She-Oaks are the favourite hunting grounds of several species of *Acanthiza* (a genus before-mentioned), though the Yellow-tailed *Acanthiza* (*Chrysorrea*), commonly known as

the Tom-tit, goes about in little mobs feeding on the ground. Down in the gully-bottoms may be found flocks of little Wax-bills (*Estrelda temporalis*); their immense nests look as if they were almost weighing down the branches of the Ti-trees which overhang the water; these nests are made of dead grass-stalks, with the entrance at the side; and the eggs are white, or rather pink when the yolk is inside, and over half-a-dozen in number.

The hills, as a whole, lack ruggedness, in all cases having rounded summits. In fact, geologists tell us that they are only the foundation of what once was a lofty, sea-coast range of mountains. The action of the atmospheric changes of past ages has worn away their surface, until now the greatest altitude reached is about 2300 ft. Although there is a lack of grandeur in the outline of their ridges and summits, one has only to follow up some of the deep defiles to find rugged crags and beetling cliffs whose crannies are the home of two or three species of Ferns, namely, *Asplenium flagellifolium*, reminding one of our common Spleenwort (*Trichomanes*); Maidenhair; a scaly Spleenwort, and Rock Fern. Between the cliffs and the stream is a large stretch of shale and fallen *débris*, but seldom in large boulders.

The banks of the streams are fringed with three or four species of Ferns; the handsomest and rarest is called Coral Fern (*Gleicheriza dicarpa*). The sombre Stringy-bark forests which clothe the higher ranges are the favourite habitat of the Black Cockatoo (*Xanthonotus lalyptorhynchus*). The only specimen I obtained of this species was shot off the nest, incubation having only just commenced. The spot chosen was a hollow in a tall, upright Gum situated in a very secluded glen. Long before we were within shot of the birds they espied us, and flew down the gulley, giving forth a loud, not unmusical cry. We lay in ambush for about thirty minutes or so, when we could hear the pair calling to one another at no great distance; from our place of hiding we could only follow their movements by sound; from the slowness of their progress we judged they were making a careful reconnoitre before returning. At last, back they

came; I fired, and fetched down my bird; but my companion, not being aware that the pair had come back, on hearing my shot, put down his gun, and thus missed getting a shot at the second bird. From the ground to the nest, about sixty feet, there was not a branch, and so we were unable to get the eggs.

The Lemon-crested White Cockatoo frequents the Stringybark ranges during the breeding season only. The same pair will use the old nest year after year. This bird will travel a great distance after food, which usually consists of grass-seeds, or, better still, the farmer's Wheat, coming home to the nest usually just before dusk. As far as I could judge, very few trips are made in a day. While talking about these Cockatoos, I may mention that, except during the breeding season, they travel about in flocks, choosing, as a rule, open country. A suitable feeding ground being found, one is posted as sentinel, while the rest (about fifty) feed in peace. From this wise policy it is next to impossible to get a shot at them in open country. I have spent hours and hours in their vain pursuit on several consecutive days. Another habit of this strange bird is to fly over any intruder at intervals at a great height in the air, each member of the mob screeching at the top of his voice. On one occasion, while camping on the banks of the River Murray, we happened to have taken up our abode near some cliffs, say, 100 ft. high; these rocks were a safe citadel for the "Cockies"; they mustered about 150 strong; every now and then, after due noisy discussion, a batch of fifty would fly over us in the manner mentioned above. The snowy whiteness of their plumage when in nature almost rivals fresh-driven snow. For quite a long period after going to roost these birds rub, munch, or crunch their two mandibles together; the united sound of a large mob at roost reminds one of running water; no doubt this habit is due to the necessity of keeping their bills sharp and not too long. In the ranges already mentioned are found Rosellas (*Platycercus Adelaidæ*), one of the favourite cage-birds of the colony, being easily taught to speak or whistle a tune. The male, when mature, puts on a handsome coat of

light crimson and blue; but its congener, *P. Pennantii*, which I have met with in the large-timbered districts of Victoria, far surpasses the above species in the richness and harmony of its colouring, the mature male being of a uniform ground-colour of rich velvety red, the feathers of the back fringed with black, and the wings and tail blue.

All the Australian Parrakeets nest in hollows in trees. Nearly every Gum-tree has suitable holes; those usually chosen are at a great elevation, and therefore since the extermination of the expert-climbing aborigines the Parrakeets have few enemies. Unfortunately the Tree Parrakeets of the genus *Platycercus* and the Honey Parrakeets of the genus *Trichoglossus* have contracted a taste for fruit, which brings them within range of shot and shell. The strangest of all the birds of the bush is, perhaps, the Laughing Jackass (*Dacelo gigantea*), one of the Kingfishers. In the twilight of evening many couples may be heard laughing in united discord from all points of the compass, no doubt outwardly rejoicing over an inward sense of comfort and repose, the effect of some Snake or small Mammal pounced upon and eaten during the day.

Mr. Ashby's paper was illustrated by a fine series of skins of Australian birds.

EVENING MEETING.—NOVEMBER 18TH, 1887.

The Proceedings of the Croydon Microscopical and Natural History Club were presented by that Club.

Mr. Tyndall read a paper on 'MARINE BIOLOGY AND SEA FISHING,' in which he called the attention of the Club to a society lately formed, called the "Marine Biological Association of the United Kingdom," the head-quarters of which are at Plymouth. After alluding to various aquariums, he described in detail the various kinds of fishing carried on upon our coasts, and enumerated forty different species of fish which are caught off Plymouth.

Mr. Edwin Ashby presented three bottles of Reptilia and Amphibia in spirits; and a number of Australian plants; also twenty-eight skins of Australian birds.

Mr. E. Ashby then described 'THE FLORA OF SOUTH AUSTRALIA':—

On the sand-hills around the Gulf of St. Vincent composite plants of the "everlasting" type abound, along with a few Sedges and Geraniums. In the Pine-woods are a few Orchids (*Caladinia dilatata*). On the roadways many English weeds are met with and a Marigold, known as the "Cape Dandelion." Another Cape plant, called "Stinkweed," with very hairy leaves, springs up in the fields after the corn has been gathered in, and keeps the ground from getting baked.

In the undulating country towards the hills three kinds of *Campanula* are found. On the hill-ranges Orchids grow more freely. Three liliaceous plants are met with; also *Euphrasia Browni*; and an azure-blue flower, "Blue-button." Amongst the *Epacridæ* on the hills a creeping *Drosera* grows. *Gravillias* are also found.

In the gulleys leguminous shrubs are met with after an ascent of 200 ft. On the hills are also the She-Oak; the *Hakaa*, with very prickly leaves; *Eucalypti*; and the *Banksia*, or Native Honeysuckle. The *Epacris* grows high up, under the Stringy-bark.

Owing to the dryness and heat, Ferns are few, but *Asplenium flagellifolium* grows in the gulleys. The Wattle, a species of *Acacia*, comes up with a pinnate leaf, which it drops, only retaining a widened leaf-stalk. All over the hill-country grow the white flowers of *Leptospermum squarrosum*, on which beetles congregate. A favourite garden-plant is known as "Native Lilac"; and a parasite, with red flowers, a *Loranthus*, is popularly known as "Native Mistletoe."

Mr. Ashby exhibited specimens of most of the plants alluded to.

EVENING MEETING.—DECEMBER 16TH, 1887.

A paper on '*Ranunculus Flammula*,' by Mr. W. H. Beeby, was presented by the author.

Mr. Miller Christy read a paper 'ON THE HYGROSCOPIC AWNS OF *STIPA SPARTEA*,' in which he described the harm done in Manitoba to Sheep and Collie Dogs through the long, sharp awns of this grass working their way through the wool or fur into the flesh of the animals. Mr. Miller Christy described in detail the construction of the awns, which peculiarly fits them for working their way into an opposing substance, under the influence of changes in moisture, which cause the shaft or awn to twist or untwist, forcing the sharp point of the seed forward.

Mr. Christy illustrated his paper with specimens of the awns and seeds of *Stipa spartea*.

Dr. Bossey exhibited dried specimens of *Stipa pinnata* and of some other species of *Stipa*.

Mr. Henry M. Wallis, of Reading, then read a paper 'ON THE BIRDS OF ARRAN MORE':—

On May 21st, Turnstones were seen on rocks at low tide between Arran More and the mainland; next day a single bird was seen; from this time until June 7th parties of Turnstones were noticed in similar situations; one flock seen on the Roannish Islands numbered thirty birds in all stages of plumage.

A pair of Purple Sandpipers were at the tide's edge under the western cliffs of Arran More on May 21st; these birds were exceedingly tame, and were probably the same pair which were noticed near the same place at intervals during the following week. A second pair were on the Roannish Islands on the 28th, but nothing occurred to suggest breeding.

At the same date a Common Gull was sitting on a nest on an inland lake. Great Black-backed Gull, Lesser Black-backed Gull, and Herring Gull were breeding on the Arran More cliffs and outlying rocks, but no Kittiwakes were seen until May 28th. Shags were abundant, and were breeding. Cormorants were uncommon; some years ago their nests were burned, and they deserted the rock on which they were accustomed to build. There are a few Guillemots and Razor-bills along the coast, but there is no great breeding station

for rock-birds in the immediate neighbourhood of Arran More. A single Puffin, picked up dead on Rutland Island, was the sole occurrence of this species noted.

Black Guillemots were generally distributed; a pair of eggs, much incubated, were taken on June 1st. On May 31st a nest had been visited containing well-fledged young; a pair of fresh eggs were brought to me on or about the same date.

A single Sanderling was observed on Rutland Island on May 25th. Dunlins were seen on the same date and on the following day, some with and others without the black breast. Ring Dotterell had eggs on May 25th. On May 22nd a young Great Northern Diver was met with in Arran Sound; another was seen on May 28th.

On May 23rd eight Choughs were noticed in a field on Arran More; the male, on finding a worm, feeds the female; they are active and powerful birds on the ground; standing with feet set well apart, they tossed the clods to right and left, and worked holes from three to four inches in depth. From this date we saw the Chough daily; it replaces the Jackdaw on Arran More and the adjacent islands and mainland. It is very sociable in habit; parties of ten or a dozen might be seen at play not far from the houses, and single birds or pairs running in and out of holes which contained no nests. The nests which we saw were usually inaccessible. By May 25th four young Choughs were hatched; the legs, feet, and claws were flesh-coloured; the beak large, and of a beautiful coral-pink. By June 5th the legs were a dull orange-colour, and the bill blackish, with flesh-coloured tip and edges. The nest was less bulky than a Jackdaw's, more green moss and less wool being used; the frame-work was of Heather-twigs. At Crohy Head, further south, two or three pairs of Choughs were breeding, but Jackdaws predominated; many hundreds of this species and a few Hooded Crows nested in the cliffs. I saw no ill-will manifested towards one species by the others.

On May 23rd a Twite's nest, with eggs, was found built in Heather among the highest rocks on Arran More. The Common Linnet is sparingly distributed on this island and over "the Rosses" generally, but the Twite undoubtedly

predominates. A Lesser Redpole was nesting in a Fuchsia-bush in a garden on Arran More. The Willows being late this season, the usual down lining was eked out with fowl's feathers. A Goldfinch nested in the same garden; this species is common wherever a few bushes invite it to breed. A Blackbird was noticed in the same garden.

On May 23rd the Tree Sparrow was met with among the cabins on Arran More. This was unexpected; we had looked out for it at every cabin since leaving Strabane without success, and had given it up. On two other occasions we saw it at or near the same place; it was apparently very local, and we doubt if there was more than one pair. The locality was a hill-side under cultivation, divided by stone walls, and dotted with dilapidated cabins, with no trees or bushes near. The House Sparrow was abundant on this island and on the mainland.

On May 31st a single Stonechat was seen on Arran More, and several pairs of Starlings were breeding among a colony of Rock Doves on the cliffs. We had seen no Starlings on the mainland since leaving Stranorlar. The natives call them Blackbirds.

The lighthouse-keeper on Arran More showed us several male Snow Buntings in nuptial plumage, shot and stuffed by himself; one was killed about the middle of April; also a Pomarine Skua, killed late in May. No birds seem to strike this light. Barnacle Geese follow this coast on migration, and rest awhile on the outlying rocks, on one of which we found a dead bird of this species.

No Eagles breed on the island now; both they and the Ravens were exterminated by poison some years since. A Peregrine or two frequented the cliffs, and, during our stay, visited the adjacent islands daily, carrying off on one occasion a chicken in each foot: even the Herring Gulls stood in awe of the female, uttering shrill cries as she approached. The Rock Dove is the Pigeon of this district, building in large numbers in the sea-caves of Arran More, but going miles inland in parties of ten to twenty for food. No other species was noticed.

On May 31st Manx Shearwaters were found upon their eggs, most of which were hard-set. The nostrils of this bird differ from those of the Storm Petrel in opening upward, instead of forward, and in each being a separate tube; whereas those of the smaller bird appear at the orifice like a single tube divided by a vertical partition. The Shearwaters seemed to prefer grassy or heathery shelves half-way down the cliffs in places sheltered from the full force of the western gales. The sitting bird is extremely fat, and in request as an article of diet among the natives, who call them "Booties" or "Puffins." They bite and scratch fiercely when touched.

On May 31st a man brought three Storm Petrels, which he had taken from their holes; they had no eggs yet. On June 3rd, and again on June 5th, we examined these nests; there were about twenty holes in use, and no eggs were found on either visit, although the little pad of white grass which serves for a nest was finished and most holes contained a pair of birds, which fought their captor gallantly, scratching and squeaking with much energy until released. On June 25th I received fresh eggs from this site, and one much incubated; this colony would hence appear to be an early-breeding one. No Fork-tailed Petrels were seen, though one of the men said he knew the bird.

Whilst investigating the Petrels' holes, a Wheatear's nest and eggs were disinterred from one, and from two others nests and eggs similar to a Reed Bunting's, but, if of this species, they were in a somewhat unusual position, being placed fully two feet from the entrance. The nests were slight structures of white grass, and no feathers were used; however, I can hardly doubt the species, although no birds were noticed. If the birds used this site at all, they could hardly do otherwise than nest in a burrow, for not a bunch of long grass or bush was in sight, and three species of Gull were breeding all around. Swifts and an occasional Swallow were seen on the mainland.

On June 4th, hearing that a bird described as the Herring Hawk nested on a lake inland, I went thither, and found a pair of Red-throated Divers breeding; the nest differed in no

wise from that of the Black-throated Diver seen in Scotland. The eggs were about 18 in. from the water's edge, and were laid in a patch of flowering Buck-bean. At least two pairs were breeding in the district. I saw also the nests and eggs of Dabchick, Teal, Red-breasted Merganser, and Common Sandpiper.

Corn Crakes are very abundant in the Rosses; wherever a patch of Meadow-grass is seen a pair or two take up their abode, and so far lay aside the habits of caution which characterize them in England as to fly and perch in full view or stand on a mole-hill and croak whilst one watches them. One nest found in a bed of nettles contained ten eggs.

We noticed the Rook, Grey Wagtail, and Ring Ouzel about fifteen miles inland; the Chaffinch, Coot, and Dipper, about twenty; and the Greenfinch and Missel Thrush, twenty-five; the House Martin not until we reached the Railway Terminus of Stranorlar, say, thirty miles from the sea.

R U L E S .

NAME.

I.—The Association shall be styled "THE HOLMESDALE NATURAL HISTORY CLUB."

OBJECTS.

II.—The investigation of the Natural History of Reigate and its vicinity, and the mutual improvement of the Members in the study of Nature.

CONSTITUTION.

III.—The Club shall consist of Members, Subscribers, Corresponding Members, and Honorary Members.

MEMBERS.

IV.—Members shall be elected by ballot or show of hands at any Ordinary Meeting. The candidate to be recommended by one or more Members at any Ordinary Meeting, and the election to take place at the Meeting next ensuing.

SUBSCRIBERS.

V.—Subscribers shall be elected in the same manner as Members, and shall have all the privileges of Members, except of holding any office in the Club, or of voting upon any matter connected therewith, or of having any right or ownership in the property of the Club.

CORRESPONDING MEMBERS.

VI.—It shall be competent for the Club to elect as Corresponding Members any gentlemen distinguished for their attainments in Natural History, either as collectors or authors, or to whom the Club may be indebted for contributions of papers or specimens; such Corresponding Members to have similar privileges to Subscribers without payment, and to be elected by the Club upon the nomination of the Committee.

HONORARY MEMBERS.

VII.—Honorary Members shall be elected by the Club upon the nomination of the Committee; and shall be exempted from the payment of subscriptions, and shall have the privileges of Subscribers.

OFFICERS.

VIII.—The Club shall, at the Annual General Meeting, elect from among themselves a President, Treasurer, Secretary, Curator, and nine Members to form a Committee of Management, three of whom to form a quorum.

VICE-PRESIDENTS.

IX.—The President shall nominate annually two Vice-Presidents from the members of the Committee.

ANNUAL GENERAL MEETING.

X.—This shall be held previous to the Evening Meeting on the third Friday in October, when the Committee shall present a Report detailing the general state, proceedings, and pecuniary condition of the Club, and proceed to the election of officers.

SPECIAL MEETINGS.

XI.—The Committee shall have the power to call a Special General Meeting at any time, and they shall do so within four weeks after receiving requisition to that effect, signed by at least five Members. The notice calling the Meeting shall state the objects for which the Meeting is called, and no other business shall be transacted.

ORDINARY MEETINGS.

XII.—These shall be held on the third Friday in every month, from October to April inclusive, or more frequently at the option of the Committee.

SUBSCRIPTIONS.

XIII.—Each Member shall pay to the Treasurer Ten Shillings on his election, and the same sum at the Annual General Meeting each year; but may compound for such Annual Subscription by payment of Five Pounds. Each Subscriber shall pay to the Treasurer Five Shillings on his election, and the same sum at the Annual General Meeting each year. That it shall be optional with the Committee to strike out the name of any Member or Subscriber who shall be in arrear with his Subscription for twelve months or more.

NEW RULES.

XIV.—Any five Members wishing to propose a New Rule, or the omission or alteration of any existing Rule, must send notice to the Secretary, who shall within a month call a Special General Meeting to consider the change proposed.

LIBRARY AND COLLECTIONS.

XV.—The Club shall form, as opportunity may offer, a Library of Reference, consisting of works bearing on the subject of Natural History; and obtain Collections of the natural objects of the neighbourhood. The Library, Collections, and Funds to be the property of the Members for the time being, and shall be vested in Trustees for the use of the Members. Contributions of Life Members shall also be invested in the names of such Trustees in such manner as the Committee may direct, the interest arising therefrom to be handed to the Treasurer for the general purposes of the Club.

ELECTION OF TRUSTEES.

XVI.—The Trustees shall consist of the President for the time being, and three other Members to be elected by the Club.

LIST OF MEMBERS AND SUBSCRIBERS.

*Names marked * are Honorary Members.*

Names marked † are Subscribers.

- †ADENEY, Miss; Bushey, Reigate.
 †ASHBY, EDWIN; Adelaide, South Australia.
 ASPLAND, THEOPHILUS L.; Deepdale, Reigate.
 ASPLAND, MRS. T. L.; Do.
 BAXTER, ROBERT C.; Hethersett, Reigate.
 BEEBY, W. H.; 14, Ridginghouse Street, London, W.
 †BEEBY, Miss E. M.; St. Alban's Lodge, Reigate.
 BONNER, JAMES; Linkfield Lane, Redhill.
 BOSSEY, FRANCIS, M.D.; Mayfield, Redhill.
 †BRASS, Rev. HENRY, M.A.; Redhill.
 *BROWN, N. E.; Herbarium, Kew.
 CAREY, FREDERICK GEORGE; Kent House, Addiscombe, Croydon.
 †CAZENOVE, Rev. Canon, M.A.; St. Mark's Vicarage, Reigate.
 †COOMARA-SWAMY, Lady; St. Alban's Lodge, Reigate.
 COOPER, THOMAS; Brighton Road, Redhill.
 CROSFIELD, JAMES B.; The Dingle, Reigate.
 CROSFIELD, HERBERT; do.
 CROSFIELD, Miss; do.
 CROSFIELD, ALBERT J.; Carr End, Reigate.
 CROSFIELD, Mrs. A. J.; do.
 CUDWORTH, JAMES I.; Woodcote, Reigate.
 CUDWORTH, Mrs. J. I.; do.
 DUNCAN, WILLIAM A.; Woodlands Road, Redhill.
 *EVELYN, W. J.; Wotton House, Dorking.
 FERNELEY, CHARLES A.; High Street, Reigate.
 †FIELD, J. LOUIS; Brooklands, Redhill.
 GABELL, ALVERSTONE, L.D.S.; Station Road, Redhill.
 GILBERT-WILLIAMS, HORACE W.; The Studio, New Street, Aberystwyth, South Wales.
 GILFORD, WILLIAM; Beech Grove, Redhill.
 †GOUGH, BERNARD B.; Sandcroft, Bridge Road, Redhill.
 †GOUGH, A. B.; do. do.

- †GURNEY, HENRY; Nutwood, Reigate.
HEAD, ARTHUR J.; Meadvale, Redhill.
HEATON, WILLIAM H.; St. David's, Beckenham.
HESKETH, R. L.; Ringley Mead, Reigate.
HOLMAN, CONSTANTINE, M.D., J.P.; The Barons, Reigate.
HOLMAN, MRS. C.; do.
†HOOPER, T. R.; Redhill.
HORNE, EDWARD, J.P.; Park House, Reigate.
HORNE, Miss; Warwick Road, Redhill.
†KENSIT, G. H.;
LAINSON, HENRY, J.P.; Colley Manor, Reigate.
LEES, JOHN; Reigate.
LINNELL, JOHN; Redstone Wood, Redhill.
LUBBOCK, Sir JOHN, Bt., M.P.; 15, Lombard Street, London, E.C.
†MARRIAGE, THOMAS SYDNEY; Bell Street, Reigate.
†MARTIN, Miss; Oxford Road, Redhill.
MENZIES, Rev. JAMES; Redhill.
NEWMAN, THOMAS P.; Hazelhurst, Haslemere.
NEWMAN, MRS. T. P.; do.
†NICHOLSON, JAMES; Salmon's Cross, Reigate,
NOAKES, RICHARD; Bridge Road, Redhill.
†PAWLE, FREDERICK C., J.P.; Northcote, Reigate.
†POULTER, DANIEL P.; Gloucester Road, Redhill.
POWELL, Dr.; Hatchlands Road, Redhill.
ROSLING, HENRY; Alders Road, Reigate.
†SALMON, C.E.; Clevelands, Reigate.
†SALMON, E.; do. do.
SELLS, VINCENT P.; Linkfield Lane, Redhill.
SHARP, J. B.; Northbrook, Reigate.
SILLITOE, F. S.; Station Road, Redhill.
STERRY, ARTHUR C.; Heatherlea, Redhill.
†STERRY, Miss Eleanor S.; do.
†STERRY, Miss IDA S.; do.
†STERRY, JOHN; Earlswood Road, Redhill.
†STERRY, MRS. J.; do.
†TINDALL, FRANCIS; Chapel Road, Redhill.
TYNDALL, WILLIAM H.; Morlands, Redhill.
TYNDALL, MRS. W. H.; do.
URQUHART, C. F.
VAUGHAN, HOWARD; 55, Lincoln's Inn Fields, London, W.C.
WALDUCK, CHARLES E.; Lee, Kent.
†WALTERS, JOHN, M.B., J.P.; Church Street, Reigate.



PROCEEDINGS
OF THE
HOLMESDALE NATURAL HISTORY CLUB

FOR THE YEARS 1888 AND 1889.

TOGETHER WITH
RULES AND LIST OF MEMBERS.



LONDON:

PRINTED BY WEST, NEWMAN & Co., 54, HATTON GARDEN, E.C.

—
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Honorary Secretary:

ALBERT J. CROSFIELD, *Carr End, Reigate.*

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PROCEEDINGS
OF THE
HOLMESDALE NATURAL HISTORY CLUB.

EVENING MEETING.—JANUARY 20TH, 1888.

The President, Mr. W. H. Tyndall, read the following Report on the 'METEOROLOGY OF REDHILL FOR THE YEAR 1887':—

So far as regards the immediate neighbourhood of Redhill, the Meteorology of the year has not exhibited any very marked features, except in respect of the dryness of the summer, regarding which further remark will be made.

BAROMETER. — During eight months of the year it has ranged on an average above the mean. From February to August, both inclusive, and again in October, the average height was over 30 in.: February having the highest average, being 30·31 in. The lowest average of the months was in November, when the mean was 29·71 in. The highest point reached, as observed by me, was 30·69 in. on February 7th, and again on April 17th; and the lowest was 28·84 in. on January 5th. On three days the barometer fell below 29 in., namely, on January 4th and 5th, and November 3rd. On 139 days it was under 30 in., but over 29 in.; and on 223 days it rose to 30 in. and upwards.

TEMPERATURE. — Notwithstanding some warm weather in the summer, the general temperature of the year was below the average of years. From January to May the year was colder than the average of years; in June and July the temperature was in excess; August was about the mean; from September to December the months were cold, especially September and October. On 101 days the thermometer during

some portion of the twenty-four hours fell below freezing (32°), but on three days only the temperature of the air failed to rise above the freezing-point, *viz.*, on January 16th and 17th, and on December 27th. During 53 days in the summer the temperature rose to 70° and upwards, but did not reach 80° ; and on 15 days it rose to 80° and upwards. The warmest day of the year at Redhill, as recorded by me, was July 4th, when the temperature in the shade reached 85° . The minimum temperature, as recorded by me, was on January 1st, when the thermometer fell to 14° in the shade.

RAIN.—The year 1887 was exceptionally dry; only 24·39 in. of rain fell in the twelve months, on 148 days. The driest month was July, when only ·67 in. fell. No rain fell, as recorded by me, from June 7th to July 3rd, both days inclusive, being 27 days, a longer period without rain than has occurred at Redhill for the last twenty-one years. In those twenty-one years, on two occasions only has the quantity of rain which has fallen been less than in 1887, *viz.* :—In 1870 the total was 23·73 in.; in 1884, 23·03 in.; in 1887, 24·39 in. As might be expected, in so dry a season, no very heavy falls of rain occurred. The heaviest continuous fall (which, by the way, was snow, not rain) was on January 3rd and 4th, when snow equal to about 1·23 in. of rain fell. On no other occasion during the year did so much as one inch of rain fall in any one continuous downpour. The other maximum falls were—·84 in. on October 29th; ·82 in. on November 3rd; ·78 in. on August 16th; ·70 in. on August 30th. The average annual rainfall for Redhill during the last twenty-one years, as recorded by me, has been 31·015 in., and the average number of days in the year on which rain fell is 178 days. The season has therefore been exceptionally dry as to the amount of rain which fell, and as to the number of days on which rain fell.

SNOW fell on 14 days, and so early in the autumn as on October 11th, but no heavy falls occurred after the one in January, before referred to.

HAIL fell on November 2nd, about noon, in a smart shower, covering the ground to a depth of about $\frac{1}{2}$ in. Hailstorms or even showers of hail are not frequent in this

district. They often accompany thunder-storms, which are not usually severe or numerous at Redhill.

Fog.—There were seven foggy days in January, from the 13th to the 15th, and from the 26th to the 29th; and foggy mornings on January 30th, and on March 1st to the 4th. November 20th and 21st were also foggy days. In mountainous districts fog produces occasionally some remarkable phenomena, among them one known as the Spectre of the Brocken, so called from being first observed, or first public notice being taken of it, in the district of the Brocken, among the Harz Mountains in Germany. In earlier days, before the true character of this phenomenon was known, the appearance of what was regarded as a spirit form of gigantic size on the mountain of the Brocken caused great terror among the people of that district. Now, however, the Brocken Spectre is known to be observable in any mountainous country, at about sunrise or sunset, during the existence of fog, subject, however, to the fog forming a bank or wall on which a shadow may be projected. It is well ascertained that the assumed gigantic size of the apparition is an optical illusion: that the spectre is in fact the shadow of the observer projected by the sun on a bank of fog. Fog-bows are occasionally seen. On a Sunday morning some years ago, in winter, I was on my way to Bletchingley. There was dense fog in the valley at the foot of Redstone Hill, but sunshine at the hill-top. Looking down over Mr. Webb's field, towards the two red houses at the foot of the hill, I noticed they were completely hidden from view by the fog, but I observed a bow of white light on the fog, not prismatic. The bow was rather more than half a circle in extent, and lasted a considerable time; how long the phenomenon did last I do not know, as I could not then spare the time to watch for its disappearance. I have not seen anything of the kind since, nor had I seen anything of the kind before.

I notice that there were specially *fine days* from February 25th to 28th; the days from morning to night were cloudless, with a fairly clear atmosphere. The temperature each night

fell considerably below the freezing-point, but from the warmth of the sun in the day the thermometer rose to 48° and 50°. From March 1st to 3rd the mornings were hazy, with low temperature at night, but the haze cleared off as the sun rose in the heavens, presenting on the 1st of the month a cloudless sky, and on the 2nd and 3rd of the month only a few light clouds were observable. On the 4th the day grew hazy, on the 5th the atmosphere was dull, and so continued until the 10th of the month.

GALES. — Strong breezes prevailed on February 2nd and 3rd. A heavy gale blew on the night of March 21st and morning of the 22nd, and again on April 1st; from the 5th to the 8th were gales from the N.E. On August 31st there was a gale which lasted the entire day, and also on the night of September 1st. A strong gale occurred on the night of October 29th, and during the day of November 1st.

THUNDER AND LIGHTNING. — As has been observed, the district of Redhill is but little disturbed by electric storms, while the neighbourhood of Wandsworth and Clapham, and the adjacent valley of the Thames often suffer from violent thunder-storms. Thunder was heard and lightning seen on July 16th, and August 16th and 17th. Thunder was heard in the daytime of August 31st. Faint lightning was seen on October 30th. On the same night a heavy storm with thunder and lightning occurred at Brighton.

Mr. T. P. Newman contributed the following paper on 'FOG':—

Fog arises primarily from calm weather. What is the cause of calm weather I will advert to later on. The earth's surface gives off heat, and becomes so cold as to condense vapour in the air near the ground, and this becomes fog or mist; or it condenses on some suitable surface, such as grass, and becomes dew. It being calm, the mist or fog so caused remains; if it were not calm, the air would move away so rapidly that there would be no time for it to condense; each successive layer passes on, and does not get time to condense.

In summer-time the mist and the dew formed by radiation

in the night yield by day, and disappear under the warming influences of the sun; and blue skies and fine weather prevail. Calm weather in summer is fine weather. It would be fine weather generally in winter, but for the fog. The rays of the sun are not powerful enough in winter to evaporate the fog, and it remains with us.

A good many people have noticed that fogs are most prevalent in calm weather, but do not know why; generally it is said that if only a wind would spring up, the fog would be blown away. To a certain extent that is right, but, as the information above given shows, *only* to a certain extent. The real reason that wind is inimical to fog is that in a wind, or even gentle breeze, the layers of air in contact with the earth's surface move away before they have time to condense, and so in a wind fog cannot be *formed*.

Another fact some of us have noted is that fog generally occurs when the barometer is *high*; and the higher the barometer the worse may the fog be expected to be. We have not, perhaps, all thought out the reason of this; some have stated that with a high barometer the atmosphere is in an electrical condition, and this helps to generate a fog, but there does not seem to be much in this theory. The simple explanation is that a high barometer generally accompanies anticyclonic conditions, and an anticyclone and calm weather almost invariably go together; while, as we have seen, calm weather is the producer of fog.

It may be well just to explain again what is the meaning of the word "anticyclone." The atmosphere is constantly moving in a series of waves forming part of gigantic circles; high pressure (or a high reading of the barometer) is found at the crests of these waves; low pressure in their hollows. When the centre of these great circular waves is *lower* than those surrounding, the weather is *cyclonic*, and cyclonic weather is generally changeable, with some wind and, in advance of the lowest pressure, rain. When the centre is *higher* than the surrounding waves, the weather is *anticyclonic*. Such it is at the present time, and has been for the last fortnight, but the centre has happily not remained in one place. It is now,

I believe, far away in the North of Russia. During the recent fogs its centre was very nearly over London, and the highest pressure prevailed over our southern and midland counties, where the fog was at its worst. But the anticyclone was a gigantic one, and made itself unpleasantly felt in *Ireland*, to right away over *Germany*; and from *Norway* to the *Bay of Biscay* and the *South of France*. Throughout the whole of that vast area fog prevailed.

It should be borne in mind that fogs are caused by condensation arising from differences of temperature between the earth's surface and the adjacent air. The earth's surface may vary in temperature. Clay will probably be colder than sand; water will differ from the surrounding land, and so fog may be different in degree in different places. The railway-cutting through the clay from Forest Hill to New Cross, being a sheltered place with a cold soil, is very subject to fog. Again, London, with its great river, is the especial home of fog. Water is very slow to be influenced by changes of temperature; the sea attains its maximum temperature late in the summer, and its minimum in the spring. Fogs therefore frequently occur over water because the air is often at a different temperature to the water. At Haslemere a spring rises and flows in a still stream of about 30 ft. in breadth, where it has been banked in, for a distance of about 100 yards. The temperature of the spring is about 40° , and in sharp frost a mist is to be seen rising from its surface, because the water retains an even temperature,—it never freezes,—while the air has fallen more than 10° below it.

The mention of London brings us to what is known as the "London particular" fog. The gloomy, yellow-black fog that gets into one's eyes and makes them smart, gets into the mouth and gives a sulphurous taste, and gets onto the face in unpleasant patches known as "blacks." The cause of this variety is not far to seek. London, with its vast population of people and horses, emits vast quantities of carbonic acid gas. The numberless chimneys in belching out their smoke emit a distillation of hydro-carbon vapour, and at the same time a quantity of sulphurous acid. The vapour condenses

on minute particles of carbon, and, according to a carefully demonstrated theory, becomes divided into countless minute spheres, upon the surface of which is precipitated a film of tarry matter due to the condensation of some of the hydrocarbon vapour. These spheres are so minute as to be invisible in the most powerful microscope. Professor Aitken filled two vessels, one with London air and one with air filtered through cotton-wool, and into these vessels he passed equal quantities of steam. In the filtered air it was transparent; in the ordinary air it became like a cloud. The condensation from the filtered air wetted the sides of the vessel; that of the unfiltered air occurred upon the minute invisible particles of solid matter suspended in it. The most potent cloud-producer was sulphur; its fog was so dense that it was impossible to see through a thickness of six or seven yards.

The vapour thus formed has a greater specific gravity than air, and consequently has a steady downward tendency, and with it brings the carbon, carbonic acid, and sulphurous acid, which in London are generated in such large quantities.

EVENING MEETING.—FEBRUARY 17TH, 1888.

The company of young people was specially invited.

Mr. Cyril Frith exhibited a series of lantern-slides illustrating 'HOMES WITHOUT HANDS.' The pictures included the burrows of beasts, nests of birds, nests of insects, cocoons, &c., and descriptions were given by Mr. T. P. Newman and Mr. A. J. Crosfield.

Mr. Frith also showed some fine photographic slides illustrating Egyptian temples.

EVENING MEETING.—MARCH 16TH, 1888.

Mr. Linnell gave some particulars of the Club's excursion on August 6th, 1887, to Norbury Park. Amongst the plants

found on that occasion he mentioned *Epipactis latifolia*, *Atropa Belladonna*, *Campanula glomerata* (in abundance), *Monotropa hypopitys*, and *Habenaria chlorantha*. Marked traces of the snow-storm of the previous winter were noticed in the Druids' Grove, where several large Yew-trees were uprooted.

Mr. T. P. Newman exhibited specimens of *Lilium tigrinum* fasciated, one of which had had 49 blossoms on a single head.

Mr. James B. Crosfield reported the capture of a living Great Grey Shrike (*Lanius excubitor*, Linn.) on Walton Heath, on October 21st, 1887. It was brought to Mr. Reeves.

Mr. W. H. Tyndall reported having repeatedly seen Siskins in his garden at Redhill during the past few weeks.

Mr. F. G. Carey then read a paper by his brother, Mr. A. D. Carey, on 'A JOURNEY ROUND CHINESE TURKESTAN AND ALONG THE NORTHERN FRONTIER OF TIBET.' (This paper has been printed in full in the 'Proceedings of the Royal Geographical Society,' December, 1887).

EVENING MEETING.—APRIL 20TH, 1888.

Mr. James I. Cudworth exhibited an interesting series of flint implements found on a farm in Tennessee, including arrow-heads, axe-heads, saws, and scrapers.

Mr. Tyndall read a paper on 'ABORIGINAL TRIBES OF CANADA,' abridged from the Report of the British Association for 1884.

ANNUAL MEETING.—OCTOBER 19TH, 1888.

The Annual Report and Balance Sheet were read, as follows:—

HOLMESDALE NATURAL HISTORY CLUB.

Annual Report, October 19th, 1888.

During the past twelve months one member and four subscribers have joined the Club, one member has been lost

through death, and eight have resigned, giving a present membership of seventy-seven.

The evening meetings were regularly held during the winter months, the meeting in February being again devoted to the instruction of young persons. On that occasion lantern views illustrating 'Homes without Hands' were exhibited by Mr. Cyril Frith, and were highly appreciated by about forty young people who were present.

The following addresses or papers occupied the evening meetings :—

- Oct. 21, 1887. 'Notes on the Fauna of South Australia,' by Mr. Edwin Ashby.
- Nov. 18. 'Marine Biology and Sea Fishing,' by Mr. W. H. Tyndall.
- Nov. 18. 'Description of the Flora of South Australia,' by Mr. Edwin Ashby.
- Dec. 16. 'Hygroscopic Awns of *Stipa Sparteae*,' by Mr. Miller Christy.
- Dec. 16. 'The Birds of Arran More,' by Mr. H. M. Wallis.
- Jan. 20, 1888. 'Meteorology of Redhill for 1887,' by Mr. W. H. Tyndall.
- Jan. 20. 'Fog,' by Mr. T. P. Newman.
- Feb. 17. 'Homes without Hands,' explained by Mr. T. P. Newman and Mr. A. J. Crosfield.
- March 16. 'A Journey round Chinese Turkistan and along the Northern Frontier of Tibet,' by Mr. A. D. Carey.
- April 20. 'Aboriginal Tribes of Canada,' by Mr. W. H. Tyndall.

The excursions taken during the summer were as under :—

Whole-day Excursions.

- May 12. Tilgate Forest.
- June 9. Newlands Corner.
- July 7. Caterham and Oxted.
- Aug. 11. Haslemere and Hindhead.
- Sept. 15. Worms Heath and Woldingham.
- Oct. 6. Abinger and Hurtwood.

Afternoon Excursions.

April 28. Tilburstow Hill.

May 26. Ranmore Common.

June 27. Tunbridge.

July 28. Buckland Hill.

Aug. 25. Reigate Heath and Rice Bridge.

The following were the EXHIBITS at the evening meetings:—

Oct. 21, 1887: Algæ from the Saragossa Sea, a Flying Fish, a small Alligator, and various seeds from the West Indies; a fine series of skins of Australian Birds. Nov. 18: specimens of S. Australian plants. Dec. 16: specimens of awns and seeds of *Stipa spartea*; specimens of *Stipa pinnata*. March 16, 1888: Reptiles in spirits from S. Australia; fasciated specimens of *Lilium tigrinum*. April 20: flint implements from Tennessee; fungus with fleshy rootlets.

DONATIONS to the Club during the past season are as under:—‘Proceedings of the Croydon Microscopical and Natural History Club,’ Feb. 1887 to Jan. 1888; presented by the Club. Paper, ‘On *Ranunculus flammula*,’ by Mr. W. H. Beeby; presented by the author. Twenty-eight skins of Australian Birds; presented by Mr. Edwin Ashby. A number of specimens of dried plants from S. Australia; presented by Mr. E. Ashby. Reptiles and Amphibia in spirits, in three bottles; presented by Mr. E. Ashby. ‘Report of British Association,’ 1887. Parts I.—VII. of ‘An Illustrated Manual of British Birds,’ by Howard Saunders, F.L.S., F.Z.S.; presented by Mr. James B. Crosfield.

Printed Proceedings for the years 1886–1887 are now in the press.

We regret that the Photographic Section has not held its meetings during the present year, and that several members of this section have resigned their membership in the Club.

years, which were themselves unusually backward. Of the spring migrants, the Willow Wren made its soft pleasing song most frequently heard, but no others, except the Chiffchaff and Swallow, were noted. From Tilburstow Hill the walk was continued westward to Bletchingley, the road running nearly along the ridge of the Lower Greensand range. Descending the southern side of the hills, lanes and field-paths brought the party down to Nutfield Station; some beautiful views were obtained by the way of the varied and wooded slopes.

The first whole-day excursion was on May 12th, to Tilgate Forest. The party, consisting of nineteen members and their friends, started from Balcombe Station under the leadership of Mr. A. C. Sterry, and walked northward and then westward to the point where they struck into the woods. The day was simply perfect, the sky absolutely cloudless, with sufficient breeze to make the air fresh and delicious. The song of the Nightingale was frequently heard, and amongst the other summer migrants, the Willow Wren, Blackcap, Garden Warbler, Whitethroat, and Tree Pipit contributed their share of music. Before reaching the confines of the Forest the loud cry of the Green Woodpecker was heard, and was repeated incessantly throughout the day in all parts of the Forest, where it seems to be one of the commonest species. The path led through beautiful and varied sylvan scenery: Oak and Birch were among the most abundant trees, the latter being pretty well in leaf, but the former still quite bare of foliage. The party ascended to the elevated ground, under which passes the Balcombe tunnel, whence the view extended over miles of woodland, the delicate green of the young Birch foliage imparting a delightful freshness to the landscape, while in the distance to the north could be seen the long range of the North Downs, with the lower range of the Greensand intervening. Stones were observed lying about bearing the impression of small worm-like animals or their casts. Other stones showed signs of ripple-marks on their surface. On descending to a small stream in a more open portion of the Forest, small casts very closely resembling those in the fossil

state above-mentioned were observed on the mud at the bottom of the water. In a part where the Forest consisted of somewhat larger trees, the song of the Redstart was heard, and the bird was presently seen perched among the uppermost twigs of a tree, uttering again and again the same short but sweet series of notes. This is an uncommon species in our district. We soon after came upon one of the Hammer ponds so characteristic of the Forest country, recalling the days long since when iron smelting formed one of the industries of Sussex. The contrast to such a pursuit now exhibited by the solitude and silence of this spot is as great as can well be imagined. Following up the course of the little stream supplying the pond for about three-quarters of a mile, another secluded pond also closely surrounded by the woods was reached. On this were a Wild Duck and her young, downy brood, and we were also surprised to see a Canada Goose swimming on it. It was supposed that this bird must have wandered from the water near the house of Mr. Nix, a mile away. A Heron was seen flying over. In the keeper's collections of dead animals and birds hung from branches in different parts of the Forest were found two Hooded Crows, one of which did not seem to have been killed much more than a week, the other possibly a month or more. These are birds not often seen in our immediate neighbourhood, though perhaps they may be met with by the keepers in the well-wooded Forest districts oftener than we suppose during the winter months. The rather monotonous and not very musical song of the Wood Wren was frequently heard during the day, and it seems to be a very plentiful species in the Forest. The cooing of the Turtle Dove was also constantly heard. Among the plants found in flower during the day were the Lesser Periwinkle (*Vinca minor*), the Marsh Violet (*Viola palustris*), the Red Currant (*Ribes rubra*), *Orobis tuberosus*, &c. *Polyporus betulinus* was found growing on a Birch-tree, and *Polyporus nigricans*, with its hard woody black pileus margined with a zone of grey, was also met with. The route was continued to Three Bridges Station, to which the party returned in three separate detachments. Those who travelled by the

later train spent some time by the large ponds adjoining the station. A Sedge Warbler was here heard uttering its rather harsh grating song, and some Swifts were seen flying over, the first that had yet been seen this season by most of the party.

Afternoon Excursion to Ranmore Common, May 26th.—Eighteen members and their friends met for this excursion. The wind was N.E., and the sky hazy, not permitting a distant prospect. A part of the time was spent among the wooded parts of the Common, and a visit was also paid to Pickett's Hole, a semicircular hollow or basin in the steep face of the hills, and one of the most beautiful of the many varied valleys and hollows on the slope of the North Downs. A pair of Red-backed Shrikes were observed near this point, but few other birds or plants of very special interest were met with. Some of the party visited Ranmore Church, which forms so conspicuous a land-mark from many directions.

Whole-day Excursion to Gomshall, Newlands Corner, and Chilworth, June 9th.—The morning opened very unfavourably, and two members who made an early start and walked to Felday and Hurtwood had a very wet walk. On a Yew-tree by the road-side specimens of *Polyporus sulphureus* were found growing, in a very young and soft fleshy stage. A Redstart was heard singing in a wood near Felday. The delightfully melodious song of the Garden Warbler was also listened to several times. Towards ten o'clock the rain ceased, the general aspect of the weather improved, and later on the sun came out and shone warmly at intervals during the day, with only an occasional shower. The party, now augmented to five, after spending a little time in the bog adjoining Gomshall Station, where the Buckbean was in flower in abundance, ascended to the top of the Chalk range, and spent some time among the beautiful country known as Hacker's Down. Specimens of the Pearl-bordered Fritillary were flying about here in immense abundance, greatly enjoying the warm sun after the rain. Other butterflies observed in the course of the day were the Wood Argus and the Painted Lady. A Chiff-chaff was heard, whose song constantly consisted of three notes instead of the usual two. The walk was continued

westward along the top of the hills, for the first part of the way through woods, and subsequently through more open country. Newlands Corner was passed, and soon after the party crossed the intervening valley to St. Martha's Hill, an outlying elevation belonging to the Lower Greensand series. The surface-sand is very soft and loose, and one wonders how it is that this small hill has been left standing alone and has escaped the general denudation. Probably this may be accounted for by the fact that it contains such a large quantity of ironstone, which has better resisted the denuding agencies that have had such effect on other parts of the series. On this hill were found *Teesdalia nudicaulis*, *Corydalis claviculata*, *Ornithopus perpusillus*, and various other minute plants. The trees in many places during the walk were observed to be much devastated by caterpillars, especially the Elms and Oaks. Some of the latter were already almost stripped of their leaves even before they had attained their full development. It is not often that the Nightingale's song can still be heard so late as June 9th, but at least three were heard singing in the course of the walk—another illustration of the general backwardness of the season.

June 27th.—An afternoon excursion to Tunbridge, to meet the members of the Tunbridge Wells Natural History and Antiquarian Society. About twenty of these were present, and six representatives of the Holmesdale Natural History Club. Most of the party embarked in boats, intending to proceed down the Medway, but the river was so high and rapid after the recent continuous and heavy rains that it was judged better, after going a short distance, to turn and go up stream instead. The weather was threatening for more rain, and it soon commenced and came down with steady continuance. As no signs of abatement appeared, a return was made, after a mile or two had been covered, to Tunbridge, where tea was provided at a hotel, instead of on the river-bank, as had been intended. The Comfrey (*Symphytum officinale*), a plant not occurring very commonly near Reigate, was found by the river-side; and a number of Demoiselle Dragonflies were observed.

July 7th. — The excursion planned was to Caterham, Barrow Green Woods, and Oxted. A constant succession of rainy days, and a threatening-looking morning, even after the rain ceased about nine o'clock, so far dissuaded members from attempting the proposed excursion that when a single member arrived at the appointed rendezvous at Caterham Station he found himself the sole representative of the Club. After reaching Oxted, so much of the day remained that he continued his walk to East Grinstead, the road for several miles crossing the almost level valley of the Weald Clay before reaching the Hastings Sand in the neighbourhood of East Grinstead, where a higher elevation is again attained. The birds seen or heard during the day included a Cirl Bunting, which was singing in a tree close to the Firestone Quarry at Godstone; a Grasshopper Warbler, whose insect-like song was heard in a wood by the road-side; a Lesser Spotted Woodpecker; and a Snipe, which was flying high in the air over a large piece of water and marshy ground adjoining, not far from East Grinstead, from time to time emitting the sound variously described as "drumming" or "bleating," which is now generally believed to be produced by the quill-feathers of the wing. The plague of caterpillars previously referred to was observed to have devastated trees of many different kinds, though the Oaks appeared to have been the chief sufferers.

July 28th. — An afternoon walk was arranged along the hills from Reigate to Betchworth. Only five members met, the weather being again extremely unpropitious, and rain fell at times heavily during a good deal of the walk. Near the top of Reigate Hill a single plant of a species of *Salvia* was pointed out by the conductor, Mr. A. J. Crosfield, but the flower was already over. The Yellow Ground Pine (*Ajuga Chamæpitys*) was found in abundance growing along the brow of the hill: the name is equally appropriate whether bestowed on account of its Pine-like leaves or resinous smell. The delicate little *Geranium columbinum* was also met with. *Hygrophorus conicus* was found plentifully: those with the pileus yellow or orange were more numerous than the scarlet ones, contrary to usual experience. The question was raised

whether the very wet season in any way contributed to this. On reaching the foot of Pebble Hill four of the party decided, in spite of the heavy rain, to prolong their walk to Box Hill, following the path through the chalk-pits and along the foot of the hill, and ascending the slope to the summit of Box Hill, where they found themselves quite enveloped in the clouds. *Cynoglossum officinale* was found growing among the herbage and bushes on the border of a field, but the flowers were all over. On some plants of the Great Mullein caterpillars of the Mullein Shark Moth were found.

Aug. 11th. — A whole-day excursion to Haslemere and Hind Head. Three of the party went by the early train, arriving at their destination about eight o'clock. They spent the early part of the day on Black Down. They were joined later in the day by eleven others, and the party was then conducted by Mr. T. P. Newman to Hind Head. The way lay through beautiful country, with ever-varying views. Passing along hill-sides covered with purple Heather and Bracken, a tolerably easy ascent brought us to the top, when a glorious view on all sides was opened out before us. To the north was the line of the Hog's Back between Farnham and Guildford, and further east the continuation of the range on the other side of the Wey Valley to Dorking, whilst in the haze of the extreme distance it was thought Reigate Hill could just be distinguished, seen beyond the long and gradual incline of Leith Hill. To the east the distant view was interrupted by a hill in the immediate neighbourhood, while on the south side the South Downs filled the landscape almost as conspicuously as the North Downs in the opposite quarter. The day was cloudy and pleasantly cool after three days of intense heat, and the distant prospect was not very clear. The party next descended into the Devil's Punch Bowl, a wide and beautiful valley, the head of which is in shape somewhat like an enormous amphitheatre. The sides were everywhere densely covered with heather and bilberries. The fruit of the latter was fully ripe and in extreme profusion, and of large size. In the boggy ground bordering a little stream which runs down the valley the Bog Asphodel grew abundantly. The Bog Pimpernel (*Anagallis tenella*), Marsh

St. John's Wort (*Hypericum elodes*), and Lesser Skullcap (*Scutellaria minor*) were also found; one or two Snipe were put up. Again ascending the sides of the Punch Bowl, we were conducted through woods and valleys, amidst scenery everywhere beautiful, back in the direction of Haslemere. In one of the woods the Stinkhorn (*Phallus impudicus*) betrayed its presence by its sickening odour, and a number of specimens were met with. *Scleroderma vulgaris*, a hard egg-shaped fungus, rough externally, and intensely black, with a strong rank smell within, was also abundant. A much more inviting species, also found abundantly growing by the paths in the woods, was *Cantharellus cibarius*. A pond of beautifully clear water surrounded by trees was passed, in which great masses of the Water Starwort (*Callitriche verna*) were growing. We were informed that the temperature was only 40° or 42°, the supply of water being from under-ground springs. The party were most hospitably entertained by Mr. and Mrs. Newman at "Hazellhurst," which is charmingly situated, with beautiful wild country almost at its very doors. Amongst the birds noticed during the day were the Nightjar and Green Woodpecker. It was observed how many of the Oaks had put forth a new growth of leaves to replace those that had been destroyed by caterpillars.

The next excursion was on the afternoon of August 25th to Reigate Heath and Rice Bridge. The party consisted of ten. The weather was delightful, with bright sun and fresh breeze. On Reigate Heath the Sundew (*Drosera rotundifolia*) was found in flower in two localities. The Purple Stonecrop (*Sedum Telephium*) was abundant along the sandy western bank. In a corn-field to the south of the Heath *Silene anglica* was plentiful. Passing down the narrow, sandy lane to Wonham Mill, the party then crossed the field to the River Mole. The banks of the river were gay with the tall spikes of Purple Loosestrife, interspersed with other river-plants. At Rice Bridge the Greater Dodder (*Cuscuta Europæa*) was found growing among the tangle of coarse herbage on the river-bank; its stems were twining over those of the Meadow Vetchling (*Lathyrus pratensis*), the Oak, the Agrimony, and a species of grass. The Gipsy Wort (*Lycopus Europæus*) was also found here.

Whole-day excursion to Worm's Heath and Woldingham, Sept. 15th. — Fourteen members and their friends started from Warlingham Station, under the guidance of Mr. W. Gilford. While ascending the hill-side above the railway some Clouded Yellows (*Colias Edusa*) were seen, but none of them could be secured. The rough flinty chalk slope below the road abounded with *Erigeron acre*. After passing through Warlingham Village, in a wood skirting the road some fine specimens of *Epipactis latifolia* were found. *Agaricus fusipes* was also here met with, its curiously-shaped and contorted stems rendering the species quite unmistakable. Another fungus found in the course of the day was *Coprinus comatus*; some specimens were afterwards cooked and eaten by one of the party, who found them excellent. Of Worm's Heath little need be said, as it was described in the report of last year's excursions. Leaving the Heath, the party presently turned to the left, the road skirting the head of the Hallelloo Valley. *Campanula glomerata* was here found in abundance. Another mile or two brought us to Woldingham, where we were bountifully provided for in a farmhouse by the kindness of our conductor. After the repast the party walked on, to the edge of the chalk escarpment, at a point where a somewhat northerly trend begins. From here a splendid prospect was obtained over all the country southwards. On the return walk some of the party went down the Hallelloo Valley, and found on the bank by the road-side two or three specimens of *Fumaria parviflora* almost in the exact place where *F. Vaillantii* was met with last year. As the specimens have both been satisfactorily identified as belonging to the two so-called species respectively, it may well be doubted whether these are anything more than varieties of the same, as the differences are at best but extremely slight. A white cruciferous plant, thought to be *Alyssum incanum*, was also gathered, probably introduced with foreign seed. The day was very fine and hot, and summer-like.

The last excursion of the season was taken on October 6th to Gomshall. Two of the party went by the early train, and thus commenced their walk soon after seven o'clock, this first portion of the day being spent on the chalk-hills north of the

railway. A single Sand Martin, the only one seen during the day, was noticed shortly after leaving Gomshall Station. Ascending the deep lane from the village, a Cirl Bunting was observed singing in a Beech-tree, although the song of its near relative, the Yellowhammer, had not been heard for some weeks. Further on, the harsh scream of Jays was heard, and the loud rattle-like note of the Missel Thrush. The abundance of both these species, especially the latter, of which flocks numbering twenty or thirty were seen, led to the conclusion that they were probably migratory visitors arrived from further north, as there seemed more of both species than are likely to be resident in the immediate neighbourhood. The Yew-trees appeared to be an attraction to the Missel Thrushes. Fungi were the special object of search on this excursion, but they were not met with, in as great variety as usual. At this early hour the grass was laden with hoar frost, and in exposed situations soft fleshy fungi were found hard-frozen. Among the woods *Lactarius blennius* and *Hygrophorus eburneus* were met with plentifully, and the beautiful white *Agaricus mucidus* was found growing on dead or doomed boughs of Beech. Primroses and Dog Violets were found in flower in various places on an open sunny slope amongst the woods. *Gentiana amarella* was plentiful on the chalky hill-sides. On the arrival of the second detachment the party was increased to twelve, and proceeded by the lanes and fields in the direction of Abinger. Soon after passing Abinger Hammer a quantity of Soapwort (*Saponaria officinalis*) was found in flower at the top of the bank by the road-side, a locality that does not appear in the 'Flora of Surrey.' At Abinger the church was visited, where harvest decorations were going forward, and some time was then spent among the Pine-woods close by. Amongst the Fungi here found, the rich crimson *Cortinarius sanguineus* was very plentiful, and deserves mention. The route then led in a westerly or south-westerly direction along paths and lanes through the woods, amidst beautiful country, to Felday. In the Pine-woods above this village the well-known Chantarelle (*Cantharellus cibarius*) was found very abundantly, and one of the party collected a large quantity to take home, intending to have them cooked for supper. From here the lane was

followed to Gomshall, where the time, until the departure of the train, was occupied in the bog close to the station. Swallows and Martins were flying about here in abundance. A list of the plants found in flower during the day was kept, and amounted to 161 species. On the concluding excursion in 1887, on October 1st, which was also to the neighbourhood of Gomshall, a similar list was kept, and comprised 137 species, being twenty-four fewer than on this occasion, though this is five days later. The list included five species of *Ranunculus* (one of which was *R. bulbosus*, a species not often to be found in autumn), five *Veronicas*, four *Geraniums*, *Anthriscus sylvestris* (another thoroughly spring species), the Marsh Marigold (*Caltha palustris*), &c., its interest arising not from the rarity of the species, but from the survival of so many to such a date. Probably this may be accounted for by the wet and cold summer, which has preserved many that would otherwise have been burnt or dried up, and allowed them to linger on, or even encouraged them to flower a second time. In the evening a display of the Fungi obtained was made at the Museum, the names being attached to such as could be identified.

Mr. J. B. Crosfield exhibited pressed specimens of several of the plants found on the excursions.

Mr. N. E. Brown, of Kew, described 'THE MADAGASCAR FLORA, AND ITS RELATION TO OTHER REGIONS':—

Madagascar lies to the south-east of Africa, and about 250 miles from its coast. With the exception of the southern end, the island is within the tropics. It is about 1000 miles in length, and has an average breadth of 250 to 260 miles, and an extreme breadth of 360 miles. It contains a central plateau of granite, surrounded by a lower region wooded in part with a band of dense forest from six or eight to fifty miles broad. In the north-east part of the island the forest reaches the coast. The granitic plateau is a region of moor-like hills, bare of trees, with shrubby vegetation and tall grasses. The soil is ferruginous-red clay. Its height is from 3000 to 5000 ft., with basaltic peaks rising to 9000 ft. Several extinct volcanoes exist.

Madagascar may be said to contain three divisions in its flora. The vegetation of all the lower region is tropical in character; but the plants of the eastern coast differ from those of the western coast, and the flora of the plateau is different again; very few species are common to all three regions. The flora of Madagascar is not completely worked out, but already it is known to contain 143 natural orders, including 980 genera, and from 3000 to 4000 species. By far the larger number of the species are endemic to Madagascar, whilst of the natural orders only one is endemic. This is the order *Chlenaceæ*, allied to *Malvaceæ*; it contains about twenty species. One in seven or eight of the genera found in Madagascar are endemic; whilst four out of every five species are endemic.

Taking part in the composition of the flora are several species belonging to such widely-spread tropical genera as *Hibiscus*, *Vitis*, *Crotalaria*, *Cassia*, *Mimosa*, *Solanum*, *Croton*, *Piper*, *Ficus*, *Ipomœa*, *Asplenium*, *Polypodium*, and *Pteris*, some of which contain in all 300 or 400 species, or even more, and are fairly represented in Madagascar. About 100 wide-spread species are found, including *Hibiscus tiliaceus*, *Sonchus asper* and *oleraceus*, *Panicum Crus-galli*, *Cynodon Dactylon*, *Cassia occidentalis*, and *Cladium Mariscus*. A few handsome flowers are found in Madagascar, such as some of the *Clænaceæ*, with large purple blossoms; but the chief interest of its flora lies in its affinities with other countries; its affinity with Africa is strongest. Amongst African genera found in Madagascar are *Phyllica*, *Pentas*, *Anthospermum*, *Ericinella*, *Philippia*, *Selago*, *Hydrostachys*, *Dombeya*, *Streptocarpus*, *Aloe*, *Landolphia*, and *Angræcum*.

Several genera and a considerable number of species are common to Madagascar, Comoro, and the Seychelles, as *Fætidia* (belonging to *Myrtaceæ*), *Phyllarthron*, and *Colea* (belonging to *Bignoniaceæ*), *Radamœa* (belonging to *Scrophulariaceæ*), *Obetia* (belonging to *Urticaceæ*), *Clematis mauritiana*, *Acalypha colorata*, *Eulophia scripta*, *Smilax anceps*, *Cyperus ferrugineus*, &c.

With Asia the affinities are slight, there being but eighteen or twenty species in common. Amongst these are *Barringtonia speciosa*, *Afzelia bijuga* and *A. scarabæoides*, *Pongamia glabra*,

one *Nepenthes* (against thirty in Malasia, China, and India), five species of *Stephanotis* (against five in China, India, and Malasia), one *Lagerstroemia* (against about eighteen in Asia), and a few others.

Certain slight but very decided affinities with America are noted. The genera common to Madagascar and America are *Erblichia*, *Ravenala* (one in Guiana and one in Madagascar), *Pedilanthus*, *Labourdonnaisia*, *Pariana*, *Rhipsalis* (belonging to *Cactaceæ*, a purely American order), *Dactylopetalum* of Madagascar, which seems to be identical with *Cassipourea* of America.

Turning now to the fauna, we shall find strong affinities with Africa. Madagascar, according to Wallace, contains sixty-six species of mammals. Of these, thirty-three species of Lemur are endemic, though Lemurs are found also in Africa and India. The Carnivora are represented by one Cat-like beast, *Cryptoprocta ferox*, with no near allies; and by eight Civets of four endemic genera, but showing affinities with African genera. The Insectivora include one Shrew and five *Centetidæ*; this latter group is also found in Cuba and Haiti. Four rats and mice represent the Rodents in Madagascar. Of land birds 100 species are known in Madagascar, of which not more than six occur elsewhere, None of the *Struthionidæ* are living, though their bones and eggs are found.

Amongst Reptiles, the Snakes are represented by two American genera, *Phylodryas* and *Heterodon*, and by *Herpetodryas*, common to China and America. Lizards are numerous; they are chiefly of African affinities. Two American genera of *Iguanidæ* occur; the family is otherwise restricted to America. One genus of *Geckoes* is found in Madagascar; it also inhabits America and Australia. Crocodiles are numerous. The Tortoises have African affinities; one species, now only found in the Aldabra Islands to the north of Madagascar, grows to five or six feet in length, and weighs 800 lbs.

Though the bones of a Hippopotamus have been found, and a Wart Hog is living, African beasts are absent. The Lion, Buffalo, Hyena, Rhinoceros, Elephant, Zebra, Giraffe, Antelopes, Monkeys, Apes, and Baboons do not occur in Madagascar. Asiatic types are also wanting, such as Tiger, Bear, Squirrel, and Deer.

To explain this distribution of species, let us turn to the British Isles. Here we find a flora largely identical with that of Germany and Norway. Not a dozen plants are endemic to the British Isles. With our birds it is the same. Now we find that the hundred fathom sea-bottom line unites us to Germany and Norway, indicating that at a recent geological period there was a land connection with the continent.

Round Madagascar we find a narrow hundred fathom line. The thousand fathom line nearly unites Madagascar to Africa, though part of the Mozambique Channel is 1600 fathoms deep. On the west coast of Madagascar the hundred fathom line runs out about eighty miles, beyond which we find a depth of from 1000 to 1500 fathoms before the African coast is reached. Geologically speaking, Madagascar was united with Africa at a very remote period; and its Fauna and Flora are in consequence of very great antiquity.

The vast deserts which now extend across Africa, Arabia, and Northern India were once sea-bottoms, and cut off South Africa from Europe and Asia. At that period Pachyderms had a much more northern range than now, as proved by bones found in England and Northern Europe. After the desert was raised out of the sea they must have spread southward, but before that period Madagascar must have become separated from the mainland. Thus the entire absence of the characteristic African animals in the island is explained. Its isolation has been long enough to allow of the modification of genera and species.

EVENING MEETING.—NOVEMBER 16TH, 1888.

Mr. C. E. Salmon exhibited specimens of Alkanet (*Anchusa sempervirens*), found at the foot of Reigate Hill, near the Rifle Butts.

Mr. J. B. Crosfield exhibited a number of Fungi, including *Xylaria hypoxylon*, from near Leith Hill; *Hirneola Auricula-Judæ*, from Reigate; *Polyporus igniarius*, from near Reigate.

Mrs. Tyndall exhibited *Crucibulum vulgare*, a small fungus resembling a bird's nest and eggs, found on her gravel-path at Redhill.

Mr. James B. Crosfield read the following 'NOTES ON AN UNUSUAL PHENOMENON':—

I arrived at Freshwater on the morning of June 15th, having crossed from Lymington to Yarmouth; the weather was rainy, though with occasional fair intervals. I started to walk along the high chalk-cliffs which extend westward about three miles, being terminated at the Needles. The weather was as little like Midsummer as can well be imagined. A strong S.W. wind was blowing, and squalls of rain from time to time came driving in from the sea. The wind was too high for the drops to be large, and it was sometimes difficult to hold an umbrella against it; but the rain was at times very thick and wetting. The line of the cliffs is nearly due east and west, and there are (as is the case on most chalk-cliffs) slight undulations which run across the line of the cliffs, and consequently north and south. It was natural to suppose that the western slope of these dips or undulations would be least exposed to the wind and rain, and accordingly, when one of the squalls came on, I took my stand on the slight slope, endeavouring to find the exact point where I should be best protected from the rain. In more than one case I succeeded in finding what I may call a cyclonic centre, where the wind was only very slight, and it was scarcely raining—in fact so little that it was not worth while keeping my umbrella up. As I stood at such a point I could see the rain driving in sheets from the south-west on the opposite slope of the dip, while along the bottom of the hollow intervening it was driving with almost equal force from the north; there was thus the curious phenomenon of two distinct showers of rain, one above and beyond the other, being driven in almost opposite directions. If I moved my position from the focus where I stood, I at once again encountered the wind and rain, from the S.W. if I went higher up the slope, and from the N. if I went lower down. It was to me a striking instance of the way in which the course of a strong current of air may

be directed by comparatively slight inequalities of the surface of the ground. I naturally supposed that the reason why I was out of the rain at these particular points was because I was out of the wind, but shortly afterwards I found that this was not necessarily always the case. The edge of the cliff is in many places more or less broken, so that one can readily descend a few feet, sometimes much more. While it was raining I happened accordingly to scramble down perhaps six or eight feet, and was surprised to find that the rain had ceased, though the wind was blowing as strongly as ever against the face of the cliff, and I was fully exposed to its force. On ascending I found it raining as before, and this I tried several times in order to make quite sure; I even found that below the top of the cliff the ground and grass were dry. I thought possibly this absence of rain might in some way be accounted for by difference of level, and when I approached the western end of the cliffs, where is a sudden drop in the level to the point that overlooks Scratchell's Bay, I almost expected that I should descend into a stratum free from rain; this, however, was not the case, as it was raining almost as thickly at the lower level as on the higher portion of the cliffs. I am quite unable to suggest any explanation of what seemed to me a singular phenomenon, and simply state the circumstances in the hope that someone present may be able to throw some light on them.

In Darwin's 'Naturalist's Voyage round the World' he narrates a somewhat similar instance as regards wind, observed during his visit to St. Helena:—"One day I noticed a curious circumstance: standing on the edge of a plain, terminated by a great cliff of about a thousand feet in depth, I saw at the distance of a few yards right to windward, some Tern, struggling against a very strong breeze, whilst, where I stood, the air was quite calm. Approaching close to the brink, where the current seemed to be deflected upwards from the face of the cliff, I stretched out my arm, and immediately felt the full force of the wind: an invisible barrier, two yards in width, separated perfectly calm air from a strong blast."

Mr. C. E. Salmon read the following paper, entitled 'NATURAL HISTORY OBSERVATIONS AT DUNGENESS':—

Starting from Rye Station early in the morning of Sept. 7th, our party, which consisted of Mr. J. B. Crosfield, Mr. E. S. Salmon, Mr. B. B. Gough, and myself, took the nearest way to the River Rother. Before crossing the Canal, great quantities of *Aster Tripolium* were noticed in flower. After crossing, we reached the salt-marshes which extend along both sides of the River Rother, where we found *Salicornia herbacea* in abundance, together with *Suaeda maritima*. Three or four plants of the Marsh Mallow (*Althaa officinalis*) were next found; this plant was also found later on in several places in abundance. These salt-marshes, which were white with *Artemisia maritima* and *A. Gallica*, both drooping-flowered and erect, were intersected by dykes, along which at high tide the water ran, and completely covered in some places the Glasswort and other water-loving plants. *Spergularia marina* and *Plantago maritima* also grew here.

By the side of the river several Gulls were observed, both flying over the water and standing on the mud-flats; and Herring, Black-headed, and Common Gulls were recognised among them. Further on, two or three Yellow Wagtails and some Wheatears were noticed, the former in brilliant plumage. On a sandy bank here *Hordeum maritimum* was abundant.

Near the little village called Rye Harbour, on pebbly ground the Yellow Horned Poppy (*Glaucium luteum*) and White Horehound (*Marrubium vulgare*) were in flower. The Strawberry-headed Trefoil (*Trifolium fragiferum*) was found in seed, and the Common Flax (*Linum usitatissimum*) in flower. *Medicago maculata*, a creeping plant, with small pea-like yellow flowers and rough prickly seeds, and a black spot on each leaflet, was also common here; and one or two plants of *Petroselinum segetum* were found in flower.

We then crossed the River Rother at its mouth by ferry, and soon after saw a party of seven Kentish Plovers, which we watched through our glasses for some time. These birds are by no means common on our shores, and most frequently seen on the coast of Sussex and Kent. The chief difference

between this species and the Ringed Plover, numbers of which were seen later, is that the former has not the black ring continued right round the throat; it is also smaller, and has black legs, while the commoner species has orange.

On the sea-shore, which here is composed solely of sand, *Cochlearia officinalis* and *Cakile maritima* were found growing plentifully, as well as *Salsola kali*; this plant used to be collected in considerable quantities, and then burned for the sake of the soda which it contains. On the sand-hills to our left *Calystegia Soldanella* grew, and the Sea Holly (*Eryngium maritimum*) grew sparingly. *Arundo arenaria* was abundant, and also nearer the sea. Flying about the sand-hills and settling on this grass, great numbers of the Silver Y Moth (*Plusia gamma*) were noticed, and the Painted Lady Butterfly (*Vanessa cardui*) was frequently seen during the day. Further on, the Sea Beet (*Beta maritima*) flourished, and also *Glauc maritima*, the flowers of which have no calyx.

The following are some of the birds that were noticed along this sea-coast:—Black-headed Gull, Lesser Black-backed Gull, Ringed Plover, and Common Sanderling, one of which was picked up dead on the sand in a fair condition. We saw a very large flock of Sanderlings seeking for food on the wet sand, and when they took to flight we saw alternately their beautiful pure white necks and breasts, and their backs, which are mottled with black, brown, grey, and dull white. Two Swifts were noticed as being late in migrating. The shore as we proceeded became more and more shingly, and soon was composed only of pebbles.

Before turning towards Lydd, *Rosa spinosissima* was found growing low on the ground. *Jasione montana* and *Armeria maritima* grew close together, making the shingle in some places quite bright with their blue and pink blossoms; and *Silene maritima* was found. In ditches near Lydd the Common Reed (*Arundo phragmites*) grew plentifully. We spent the night at Lydd, and took an early train the next morning to New Romney and Littlestone. Almost immediately after leaving the station several Whinchats were seen, and closely observed; and before reaching the sea the Smooth Sea-heath

(*Frankenia levis*) was found. On reaching the shore we first went to the east, and soon saw on the wet sands a large flock of Dunlin and Ringed Plovers, and further off four Curlews engaged in feeding. We here gave chase to a Stoat or Ermine which we espied, but it escaped down one of the many rabbit-holes which undermined the ground.

We then retraced our steps and went in the direction of Dungeness, after first visiting some salt-marshes rather more inland, where a Dunlin and Curlew were picked up, but were not in a good enough condition for preserving. In these salt-marshes were found most of the plants that were at Rye, as the Glasswort, Sea Blite, and others. The sea-coast, which is here pebbly, was then followed to Dungeness Point, and on the way were seen a great quantity of Gulls, among them the Herring, Common, Lesser Black-backed, and Greater Black-backed; a flock of Oystercatchers were next seen flying over the sea, and later on some Curlews. A Common Guillemot was picked up on the beach. At Dungeness Point one plant of the Sea Kale (*Crambe maritima*) was found, and nearer Lydd some plants of *Senecio viscosus* were noticed. A little further towards Lydd a good many plants of *Silene nutans* were found on the shingle; the empty seed-vessels were noticed to have a perfectly circular hole in the side of each. A good many Hares were observed here on the shingle. The pebbles in some places were completely covered with tangled masses of the Greater Dodder (*Cuscuta europæa*), which was parasitical on Wood Sage and Broom, and occasionally on Foxglove. Nearer Lydd, in the middle of this pebbly ground we came across a large pond, in the marshiest parts of which *Ranunculus Lingua* grew rather plentifully, while round the edge *Lastrea Thelypteris* covered the ground with its delicate fronds. Just on the outskirts of Lydd, by the side of a stream the Wild Celery (*Apium graveolens*) flourished; by this same stream the Great Water Dock (*Rumex Hydrolapathum*) was noticed growing to a height of five feet or more. *Mercurialis annua* was also found in flower near Lydd.

Mr. Salmon exhibited some good specimens of several of the plants named.

EVENING MEETING.—DECEMBER 14TH, 1888.

Mr. C. E. Salmon exhibited a specimen of *Saponaria vaccaria* in fruit, found on Reigate Hill.

Mr. John Linnell exhibited dried specimens of *Ophrys apifera* which he found growing near the top of Redstone Hill. He thought it unusual to meet with the Bee Orchis on sandy soil.

On behalf of Mr. John Lees, a presentation was made of a number of Ferns which were dried and named by the late Mr. Charles Green. The thanks of the Club were voted to Mr. Lees.

Mr. E. Salmon reported having seen two Hooded Crows in Tilgate Forest.

A paper by Mr. A. J. Crosfield was read, entitled 'My ROCK GARDEN':—

Mr. Crosfield described a number of plants out of over 200 species that had blossomed during the year on a small piece of rockwork in his garden, beginning early in January with the Sweet-scented Butterbur (*Petasites fragrans*). Many were British species, but he had also grown plants from the Swiss Alps, the Pyrenees, Hungary, Siberia, Spain, Portugal, Italy, Canada, California, South America, Kashmir, and Persia.

Amongst the most charming plants for the rock-garden are various species of Saxifrage, Sedum, and Primula. In March and April a number of bulbous plants make the garden gay, such as Anemones, Narcissi, Crocuses, and the Spring Star-flower (*Triteleia uniflora*), from South America. During May the garden was brilliant with the flowers of Columbines, Peony (*Pæonia tenuifolia*), from Siberia, the South American Wood Sorrel (*Oxalis floribunda*), Pansies (*Viola lutea*), *Phlox subulata*, *Veronica prostrata*, the Alpine Wallflower (*Cheiranthus alpinus*), Common Thrift, the Iceland and Welsh Poppies, the Globe-flower (*Trollius europæus*), *Lychnis Viscaria*, *Geranium sylvaticum*, more than one species of *Iris*, *Erinus alpinus*, and other less striking kinds. Sixty fresh species came into blossom during June, including the Scarlet Larkspur (*Delphinium nudicaule*) from California, the Cheddar Pink (*Dianthus*

casius), the Japanese Rose (*Rosa rugosa*), *Crucianella stylosa*, from Persia, the Blue Satin-flower (*Sisyrinchium Bermudiana*), the Alpine Rhododendron (*R. ferrugineum*), St. Bernard's Lily (*Anthericum plumosum*), the Star of Bethlehem (*Ornithogalum umbellatum*), *Veronica saxatilis*, *Linnaea borealis*, *Dianthus superbus*, five species of *Campanula*, *Linum flavum*, and the American Bramble.

Mr. Crosfield exhibited specimens of several of the plants named therein.

Mr. James B. Crosfield exhibited a series of white eggs. The species shown were Green Woodpecker, Kingfisher, Wryneck, Dipper, Martin, Sand Martin, Ring Dove, Stock Dove, Turtle Dove, Barn Owl, Tawny Owl, Long-eared Owl, Golden Eagle (one egg almost white), Grey Lag Goose, Shag, Cormorant, and Gannet. He remarked that birds which lay white eggs usually breed in holes. He supposed that white was the primitive colour of eggs, and that other colours were acquired for protection; or else that birds laying white eggs acquired the habit of resorting to holes for protection, white eggs being the most conspicuous, and therefore most in danger of being destroyed by enemies. Grebes, which lay white eggs, have adopted the habit of covering their eggs up when they leave the nest. It is manifest that many eggs have protective colouring, such as those of Terns, which lay on shingle, and Red Grouse, Golden Plover, and Sandpipers, which lay in very slight nests on moors. Sea-birds which congregate in vast numbers at their breeding-stations are liable to various attacks from enemies, but a sufficient proportion escape to keep the species alive. Many Geese breed far to the northward in the Arctic regions, where they are free from the attacks of many foes; but the Grey Lag Goose, which lays its white eggs in open nests in Sutherland, is subject to the attacks of Hooded Crows and other enemies, and is in fact becoming a very scarce bird, and is in danger of extinction as a British species.

EVENING MEETING.—JANUARY 18TH, 1889.

Mr. C. E. Salmon exhibited specimens of Treacle Mustard (*Erysimum cheiranthoides*), found on January 3rd, 1889, in a field near Nutfield.

Mr. J. B. Crosfield presented the following list of plants found in flower during December by Messrs. Gough, and Salmon, and himself, making in all 163 species:—

Ranunculus repens	Ulex Europæus
R. acris	U. nanus
R. bulbosus	Cytisus scoparius
Caltha palustris	Melilotus alba
Papaver Rhœas	Trifolium pratense
Corydalis claviculata	T. arvense
Cardamine hirsuta	T. procumbens
Draba verna	T. minus
Sisymbrium officinale	Vicia sepium
Alliaria officinalis	V. hirsuta
Capsella Bursa-Pastoris	Geum urbanum
Lepidium campestre	Rubus fruticosus
L. Smithii	Fragaria vesca
Sinapis nigra	Potentilla reptans
S. alba	P. Fragariastrum
Reseda Luteola	P. Tormentilla
R. lutea	Spiræa Ulmaria
Viola tricolor	Alchemilla arvensis
V. arvensis	Poterium Sanguisorba
Polygala vulgaris	Agrimonia Eupatorium
Lychnis diurna	Spergula arvensis
L. vespertina	Sanicula Europæa
L. Flos-Cuculi	Pimpinella Saxifraga
Arenaria serpyllifolia	P. magna
A. trinervis	Sison Amomum
Stellaria media	Æthusa Cynapium
S. graminea	Angelica sylvestris
Cerastium (sp.)	Pastinaca sativa
Malva sylvestris	Heracleum Sphondylium
M. rotundifolia	Anthriscus sylvestris
Hypericum perforatum	Chærophylum temulum
Geranium Robertianum	Daucus Carota
G. molle	Torilis Anthriscus
G. dissectum	Hedera Helix
G. columbinum	Viburnum Lantana

Galium Aparine	Anchusa sempervirens
Sherardia arvensis	Digitalis purpurea
Fedia olitoria	Veronica serpyllifolia
Dipsacus sylvestris	V. officinalis
Scabiosa Columbaria	V. Chamædrys
Knautia arvensis	V. agrestis
Helminthia echiioides	V. Buxbaumii
Thrinicia hirta	V. arvensis
Pieris hieracioides	Scrophularia aquatica
Apargia hispida	Linaria Elatine
Hypochaeris radicata	L. Cymbalaria
Sonchus oleraceus	Thymus Serpyllum
S. asper	Origanum vulgare
Crepis virens	Teucrium Scorodonia
Leontodon Taraxacum	Ballota nigra
Hieracium Pilosella	Betonica officinalis
Lapsana communis	Stachys arvensis
Carduus nutans	Galeobdolon luteum
C. acanthoides	Lamium album
Cnicus lanceolatus	L. amplexicaule
C. palustris	L. purpureum
Carlina vulgaris	L. incisum
Centaurea nigra	Prunella vulgaris
C. Cyanus	Primula vulgaris
Gnaphalium uliginosum	Anagallis arvensis
Filago minima	Scleranthus annuus
Petasites fragrans	Rumex obtusifolius ?
Erigeron acris	Mercurialis perennis
Senecio vulgaris	Euphorbia Peplus
S. Jacobæa	E. exigua
S. aquaticus	E. amygdaloides
Inula Conyza	Urtica urens
Bellis perennis [mum	Phalaris canariensis
Chrysanthemum Leucanthemum	Alopecurus agrestis
C. segetum	Phleum pratense
Matricaria inodora	Holcus lanatus
Achillea millefolium	Arrhenatherum avenaceum
Campanula rotundifolia	Melica uniflora
C. Trachelium	Poa annua
Specularia hybrida	Dactylis glomerata
Calluna vulgaris	Avena flavescens
Erica Tetralix	Bromus sterilis
E. cinerea	B. mollis
Vinca minor	Brachypodium sylvaticum
Erythraea pulchella	Lolium perenne
Echium vulgare	Triticum caninum
Myosotis arvensis	

Mr. W. H. Tyndall read a paper entitled 'SOME ACCOUNT OF THE ERUPTION OF KRAKATOA AND ITS EFFECTS, TAKEN FROM THE RECENTLY-PUBLISHED REPORT OF THE ROYAL SOCIETY, containing the results of the investigations of the Committee appointed to investigate the subject.'

EVENING MEETING.—FEBRUARY 15TH, 1889.

The company of young persons was specially invited.

Mr. W. H. Tyndall read a paper on 'ANTS AND THEIR WAYS.' In this paper Mr. Tyndall endeavoured by a popular description of the well-known characteristics of Ants to awaken an interest in the minds of young people, "such as may lead to a closer study of their habits, either from perusal of books or personal observation."

Mr. H. M. Wallis, of Reading, gave a popular and amusing address, entitled 'EYES AND NO EYES.'

Several microscopes and a number of specimens illustrating various branches of Natural History were exhibited.

EVENING MEETING.—MARCH 15TH, 1889.

The following gentlemen brought microscopes, and exhibited a fine selection of objects:—Dr. Bossey, Dr. King (of Dorking), Mr. W. H. Tyndall, Mr. W. F. Tindall, Mr. E. S. Salmon, Mr. A. B. Gough, Col. Clarke, Mr. H. Rosling, jun., Mr. A. C. Sterry, Mr. R. Binns, Mr. D. P. Poulter. The following were amongst the objects shown:—Spiculæ of Sponge; section of Basalt; spinous skin of Dog-fish; skin of Cat's tongue; eye of Dytiscus, showing a short text clearly seen in 210 facets; parasite of Dove; scales of wing of Peacock Butterfly; capsules of Moss (*Funaria hygrometrica*); *Polycistinae* from Barbadoes; *Conochilus volvox*; Rotifers; elytron of *Eupholus*; Spider's eyes; tongue of Merry Dancer (*Hilara*); photographs of Jupiter and Saturn; Diatom, *Muscia*, from Mexico; proboscis of Blow-fly; flower of Grass; Lace-fly.

EVENING MEETING.—APRIL 12TH, 1889.

Mr. A. J. Crosfield exhibited specimens of *Helleborus fetidus*, gathered at Clayton, Sussex; and of several plants out of his garden, including *Draba aizoides*, *Primula viscosa*, &c. He remarked on the late arrival of the migratory birds this year, especially the Wheatear, which was seen near Brighton on April 6th, being a month behind its usual time of arrival.

Mr. A. W. Brackett, of Tunbridge Wells, read a paper on 'THE SEA SERPENT':—

He said that for ages the idea of the existence of a sea monster has prevailed on the coast of Norway, and the same idea is current on the New England coast. The Poet Laureate has embodied the idea in his poem upon the fabulous Kraken. Bishop Pontopidon last century collected evidence on the occurrence of the Sea Serpent; he recorded that Captain de Ferry, in August, 1747, saw near Molde, on the Norwegian coast, a monster having the gliding form of a serpent, a head like a horse, and a neck two feet long. In 1846 the Norwegian papers described a monster which was seen by numbers of people near Molde, on the Romsdal Fiord; it was described as from 50 to 100 feet in length, with a head the size of a ten-gallon cask, and a mane of long-spreading hair. Some men in a boat fired at it, when it came straight towards them, but on reaching shallow water dived and disappeared; they said its snout was sharp, and its head semicircular. A letter in 'The Times' dated November 4th, 1848, and signed by "Oxoniensis," gave the evidence of the Norwegians who had seen it.

In August, 1887, eleven witnesses deposed that they had seen near Cape Ann, Massachusetts, a huge serpent-like creature, of a dark brown colour, with white under its neck; some said they saw protuberances on its neck. Col. Perkins thought he saw a horn on its head (this was probably its tongue thrown out). Most people at Cape Ann had seen it.

On May 15th, 1883, an English crew off Margaret's Bay, near Halifax, saw a head six feet in length upon a neck six feet in length gliding through the water; the neck was the

size of the bole of a tree, and was dark brown or black, streaked with white.

On August 6th, 1848, at 5 p.m., the crew of the 'Dædalus' frigate, when between the Cape of Good Hope and St. Helena, saw a Sea Serpent for twenty minutes. They described having seen sixty feet of the Serpent's body on the surface of the sea, with the head and shoulders raised about four feet above the surface. The neck behind the head was fifteen or sixteen inches in diameter. It had a mane like a horse's, and no fins. It swam against a cross-sea at a rate of ten miles an hour, at a distance of 200 yards from the 'Dædalus.' Its eye, mouth, and nostrils were clearly seen.

A propos of the 'Dædalus' Sea Serpent, Mr. R. Davidson wrote to the 'Bombay Times' of January, 1849, stating that in the year 1829, when on his voyage to India in the 'Royal Saxon,' when S.W. of the Cape of Good Hope, he and Capt. Petrie saw a similar animal swimming within thirty-five yards of the ship, with a third of its length above water.

In 1875 the captain, officers and men on board the barque 'Pauline' watched a Sea Serpent for a quarter of an hour twined round a Sperm Whale, which it eventually succeeded in dragging to the bottom.

Without wishing to express a decided opinion, Mr. Brackett suggested that all the above descriptions point to the existence of a huge Saurian, possibly a species of *Plesiosaurus*.

Mr. W. H. Tyndall read 'NOTES ON METEOROLOGY OF REDHILL FOR 1888':—

The general aspect of the year has not been genial. More rain has fallen than in 1887, and the temperature of the summer months has been below the average, in July especially.

BAROMETER. — The pressure reached 30 in. on 196 days, in place of 223 in 1887; 29 in. on 168 days, in place of 139 days in 1887; it fell below 29 in. on 2 days, in place of 3 in 1887.

The THERMOMETER fell to the freezing-point or below on 91 nights, in place of 101 nights in 1887; but it rose to or over 70° on 28 days only in 1888, against 53 days in 1887, and it rose

to 80° or above on 3 days only, compared with 15 days in 1887. The temperature of 1888, as compared with the average of many years (50), at Greenwich, is as under:—

	GENERAL AVERAGE.	AVERAGE FOR 1888.		GENERAL AVERAGE.	AVERAGE FOR 1888.
Jan. .	36·5°	36·94°	July .	62·0°	57·50°
Feb. .	39·0°	33·92°	Aug. .	61·5°	58·98°
March	42·0°	38·07°	Sept. .	56·5°	56·41°
April .	47·5°	43·54°	Oct. .	50·5°	45·55°
May .	53·5°	51·85°	Nov. .	43·5°	48·83°
June .	59·5°	58·63°	Dec. .	39·0°	39·65°

It will be seen that during nine months of the year the temperature was below the average; in February more than 5°, in March nearly 4°, in July 4½°, in October nearly 5°. In January and December the temperature was near the average, a little above it; and in November there was a good burst of the Indian summer, the temperature being more than 4½° above the average. On four days only in the year the thermometer failed to rise above the freezing-point during some portion of the twenty-four hours, namely—

On January 16th, when it reached only 31°	
February 22nd,	31°
„ 23rd,	28°
„ 24th,	30°

The 11th and 12th of July were very cold for the season, the mean temperature of those days being 52° and 50·5° respectively, more than 10° below the average. On one of those days snow fell in considerable quantities in N. and E. Derbyshire. In Sweden, where a cool summer may be expected, the thermometer was 13° to 17° higher than in London.

RAIN.—The total quantity which fell in the year was 30·24 in. The average registered by me for 22 years is 30·98 in., so that the rainfall of the year was a little under the average. Rain to the depth of ·01 in. or upwards fell on 176 days. The average yearly rainfall for the last 22 years is 178 days, so that the quantity of rain and the number of

days on which rain fell was about the average. There were no very heavy falls of rain; 1·11 in. fell on November 1st and 2nd, and ·94 in. on June 26th. Other falls above half an inch were on March 10th, ·52 in.; July 15th, ·58 in.; August 28th, ·76 in.; November 25th, ·64 in.

SNOW fell on 19 days, sometimes very slightly, not sufficient to register ·01 in. The first snow fell on January 27th, the last on April 8th. The heaviest falls were on February 13th and March 19th.

LIGHTNING and THUNDER occurred on June 25th, July 18th, July 30th, and September 9th.

A RAINBOW was observed at 9.30 a.m. on December 27th.

FOG prevailed all day on January 11th and 12th, and for several days in December.

WIND. — No very heavy gales were noticed, but strong winds prevailed on January 15th from N.E.; from March 7th to 11th from S.W.; on March 17th from N.E.; from November 20th to 25th from S.W.

A few very fine, clear days are recorded, *viz.*, on January 23rd and 24th, especially on the 23rd; again on April 30th. There were many ordinarily fine days, but on those named the air was exceptionally clear, and the sky exceptionally blue.

ANNUAL MEETING.—OCTOBER 18TH, 1889.

The Annual Report and Balance Sheet were read and adopted, as follows:—

HOLMESDALE NATURAL HISTORY CLUB.

{*Annual Report, October 18th, 1889.*

Since our last Annual Meeting five subscribers have joined the Club, one of our members has been lost to us by death, three have resigned, two have left us through removal from the neighbourhood, leaving the present membership seventy-six.

The attendance at the ordinary evening meetings during the winter averaged twenty-one, whilst over fifty persons were present at the meeting specially arranged for young people in February.

METEOROLOGY. — OXFORD ROAD, REDHILL, SURREY (1888).

BAROMETER.				THERMOMETER.						RAIN.			
Month.	Max.	Date.	Min.	Date.	Max.	Date.	Min.	Date.	Average.		Mean.	Total of No. of Days Month. -01 fell.	
									Max.	Min.			
Jan. .	30.72	10	29.48	2	50.0	8, 9	22.5	29	41.86	32.53	36.94	0.98	18
Feb. .	30.33	28, 29	29.43	19	50.0	6	18.5	24	38.60	29.24	33.92	1.54	14
March	30.24	1	28.88	28	53.0	10	22.5	1	49.20	32.95	38.07	4.31	21
April .	30.24	7	29.60	20	63.5	15	25.5	6	50.82	36.27	43.54	2.15	15
May. .	30.48	11	29.45	1	74.5	19	32.5	10, 11	62.44	41.26	51.85	0.98	4
June .	30.26	1, 2	29.62	9	82.0	25	41.0	17	67.80	49.47	58.63	4.02	18
July .	30.14	13	29.50	17, 18	73.5	18	42.0	10	67.03	50.98	57.50	5.70	24
Aug. .	30.30	19	29.72	21	80.0	10	42.0	31	66.94	51.02	58.98	1.71	12
Sept. .	30.50	13	29.70	30	71.5	15	36.0	30	63.83	48.98	56.41	1.11	11
Oct. .	30.44	22	29.36	2	66.0	27	28.0	7	53.95	37.16	45.55	1.69	10
Nov. .	30.24	23	29.27	30	57.5	16	32.0	6, 30	54.83	42.15	48.83	4.32	20
Dec. .	30.46	16	29.14	22	55.0	5	23.5	10	44.64	34.66	39.55	1.73	14
Year.	30.72		28.88		82.0		18.5				47.60	30.24	176

At the meeting in March a fine series of objects were shown under the microscope. The following gentlemen kindly took part in the exhibition :—Dr. Bossey, Dr. King (Dorking), Col. Clarke, Messrs. W. H. Tyndall, D. P. Poulter, A. C. Sterry, R. Binns, Henry Rosling, E. S. Salmon, A. B. Gough, and W. F. Tindall. A very enjoyable evening was spent.

A noteworthy feature of the winter session was the number of plants exhibited or reported in flower. 163 species of wild flowers were obtained in bloom during December, 1888; 67 species during January, 1889. The mildness of the early part of December largely brought about these results. Messrs. J. B. Crosfield, B. B. Gough, and C. E. Salmon were the chief observers.

The following subjects occupied the evening meetings :—

- Oct. 19, 1888. Annual Report and Balance Sheet.
- „ ‘Report of Excursions, 1888,’ by Mr. James B. Crosfield.
- „ ‘The Madagascar Flora, and its relation to other Regions,’ by Mr. N. E. Brown.
- Nov. 16. ‘Notes of an unusual Meteorological Phenomenon,’ by Mr. James B. Crosfield.
- „ ‘Natural History Observations at Dungeness,’ by Mr. C. E. Salmon.
- Dec. 14. ‘My Rock Garden,’ by Mr. A. J. Crosfield.
- Jan. 18, 1889. ‘Some Account of the Eruption of Krakatoa and its effects, taken from the recently-published Report of the Royal Society,’ by Mr. W. H. Tyndall.
- Feb. 15. *Juvenile Meeting.*
- „ ‘Ants and their Ways,’ by Mr. W. H. Tyndall.
- „ ‘Eyes and No Eyes,’ by Mr. Henry M. Wallis, of Reading.
- March 15. *Exhibition of Microscopes.*
- April 12. ‘The Sea Serpent,’ by Mr. A. W. Brackett, of Tunbridge Wells.
- „ ‘Notes on Meteorology of Redhill for 1888,’ by Mr. W. H. Tyndall.

The interest of the evening meetings was greatly enhanced during the past winter season by the large number of *Exhibits*, including the following :—Oct. 19, 1888: Curiously fasciated

bough of Hawthorn; twenty-two species of rock plants in bloom. Nov. 16: specimens of Alkanet (*Anchusa sempervirens*) from the foot of Reigate Hill; Fungi, including *Crucibulum vulgare*, *Xylaria hypoxylon*, *Hirneola Auricula-Judæ*, and *Polyporus Igniarius*; plants from Dungeness. Dec. 14: *Saponaria vaccaria*, in fruit, from Reigate Hill; seventeen species of of white eggs. Jan. 18, 1889: *Erysimum cheiranthoides* from near Nutfield. Feb. 15: skins of birds, &c. March 15: objects shown under the microscope. April 12: *Helleborus fatidus* from Clayton, &c.

The Club is indebted to several kind friends for the following *Donations*:—Ferns, dried and named by the late Mr. Charles Green; presented by Mr. John Lees. Parts VIII. to XVIII. of 'An Illustrated Manual of British Birds,' by Howard Saunders, F.L.S., F.Z.S.; presented by Mr. J. B. Crosfield. Reprints of papers on 'The Two Valerians,' '*Callitriche polymorpha*,' and 'On some British *Viola* forms,' by Mr. W. H. Beeby, A.L.S.; presented by the author. Reprints of Botanical Articles, and a Catalogue of British Mosses; presented by Mr. Arthur Bennett, F.L.S. Two numbers of 'The Selborne Society's Magazine'; presented by the Society. 'Proceedings and Transactions of the Croydon Microscopical and Natural History Club,' Feb. 1888, to Jan. 1889; presented by the Club. 'Report of the British Association for the Advancement of Science, 1888'; presented by the Association.

The Excursions taken during the summer were as under:—

Whole-day Excursions.

- May 11. Burford Bridge, Swallows of the Mole, and Rammore Common.
- June 22. Hayes Common and Holwood Park.
- July 20. Holmwood and Leith Hill.
- Aug. 24. Eastbourne, Beachy Head, and Seaford.
- Sept. 28. Ashdown Forest.
- Oct. 12. St. Leonard's Forest.

Afternoon Excursions.

- April 27. Shirley Wood and Addington.
- May 25. Earlswood Common and Sidlow.

- June 8. White Hill.
 July 6. Mason's Bridge and Ham Farm.
 Aug. 10. Betchworth Hill.
 Sept. 14. Gomshall, Hockhurst Downs, and Netley Heath.

During the time that the Industrial Exhibition was open in the Public Hall, in May last, the Museum was thrown open for public inspection, and was visited by large numbers of persons. Some of our members attended with microscopes, and greatly added to the gratification of the visitors.

ABSTRACT OF ACCOUNTS.

<i>Receipts.</i>			<i>Expenses.</i>		
Oct. 19, 1888, to Sept. 1889.	£	s. d.	Dec. 15, 1888, to Jan. 26, 1889.	£	s. d.
Balance	27	4 2	Footpath Association .	0	10 0
'Flora of Surrey'	0	17 10	Printing 'Proceedings'	22	4 10
Sale of 'Proceedings' ..	0	3 0	Rent, Gas, & Cleaning	17	6 5
Subscriptions	31	16 0	Insect-boxes, &c.	4	8 9
			Printing	2	4 10
			Collector's Commission	1	9 0
			„ Postage Stamps	0	7 0
			Balance, Oct. 17, 1889	11	10 2
	£60	1 0		£60	1 0

Examined and found correct, { Wm. Hy. Tyndall, }
 October 18th, 1889. { F. Bossey, } *Auditors.*

The following Officers were elected for the ensuing year:—
President, Mr. W. H. Tyndall; *Treasurer*, Mr. J. I. Cudworth;
Secretary, Mr. A. J. Crosfield; *Curator*, Mr. John Linnell;
Committee, Dr. Bossey, Messrs. F. G. Carey, T. Cooper, J. B. Crosfield, A. J. Head, R. L. Hesketh, R. Noakes, A. C. Sterry, and the Rev. Jas. Menzies.

The following were brought for exhibition:—A Rose in which the stem was prolonged through the flower, and crowned with leaves, and in which the calyx took the form of ordinary leaves; brought by Dr. Bossey. A *Selaginella* (probably *S. involvens*); brought by Mr. R. Noakes. Carpels of *Excæcaria agallocha*, a plant from China, utilised by the larva of a moth. Specimens of *Drosera heterophylla* and *D. stolonifera*, both bulbous plants from Western Australia; also of *Roridula dentata*, a fly-catching plant belonging to *Droseraceæ*,

from South Africa; also of the Silver Tree, *Leucodendron argenteum*, belonging to the natural order *Proteaceæ*; the Silver Tree is only known to grow on the somewhat limited area of Table Mountain, near Cape Town; all exhibited by Mr. N. E. Brown.

Mr. N. E. Brown, of Kew, described 'THE ARCTIC FLORA':—

He defined the Arctic Flora as the flora of the region north of the Arctic Circle, but also including the southern extremity of Greenland, which extends to the south of the Arctic Circle. As compared with other floras, it is a very young flora, but many of the forms are antiquated. Generally speaking, it is a poor, stunted flora. The Arctic flora is not confined to the Arctic Regions; it is world-wide, and the only world-wide flora. It extends southward on level ground, and also appears on mountain ranges in all latitudes.

The summer temperature of the Arctic Regions ranges from 32° to 45° Fahr. The winter temperature, except in West Lapland is below zero. The mean annual temperature is 30°, that of Lapland 37°. The June temperature of Lapland is 40° to 45°, September 37° to 42°, being greatly influenced by the Gulf Stream. In May or early June a warm south wind usually blows in the Arctic Regions, the snow melts fast, and flowers rush into bloom. The contrast is great between the conditions of climate in the Arctic Regions and in the Arctic-alpine zone of the tropics, and there is a corresponding difference in the flora, although some species are common to both.

One characteristic of the Arctic flora is the absence of trees and shrubs. North of 72° no trees or shrubs are met with. Where the country is low, the vegetation is of a moorland or bog character. The interior of Greenland is hilly and ice-bound; hence vegetation is confined to a narrow strip of coast. In Spitzbergen vegetation is found on narrow terraces, slopes, and ledges near the coast; but at 78° N. lat. a vigorous vegetation is met with of about 90 flowering plants, 70–80 mosses, 150 lichens, and 10–15 fungi; and numerous herds of Reindeer pasture there. At Magdalena Bay, 79½° N. lat., an abundant and vigorous vegetation has been found at an elevation of more than 2000 ft. above sea-level. At Brandy-

wine Bay, 80° 24' N. lat., the mountain-sides for more than 1000 ft. above the sea have a fair amount of vegetation on them; and on the moss-covered terraces below the bird-cliffs some of the plants, such as species of *Ranunculus* and *Cochlearia*, were found a foot in height.

The Arctic zone may be divided into five regions:—The Arctic Asiatic; the Arctic European; Greenland; East Arctic America; West Arctic America.

The total Arctic flora contains about 800 species; this may be contrasted with the rich flora of the small tropical island of New Caledonia, with over 3000 species. The great majority of the Arctic flora occurs in Scandinavia, over 600 species; though a great proportion of these 600 species occur also in the other Arctic regions. The numbers in the following table (which, together with most of the other numbers, are taken from Sir J. D. Hooker's essay) give a clear idea of the predominance of the Scandinavian element. Thirty species in Scandinavia are Asiatic or American.

In Arctic Asia, with 230 species, over 180 are Scandinavian.

W. Arct. America, 360	„	250	„
E. Arct. America, 370	„	260	„
Greenland, 320	„	294	„

Although Greenland extends far to the south of the Arctic Circle, it contains no temperate flora. *Papaver nudicaule*, the Iceland Poppy, extends furthest north of any flower that has been found.

Over 490 species of Arctic plants occur in the Alps; 120 cross the Mediterranean; 300 occur in the Himalayas; 360 in North Temperate America; 40 in Tropical America; 70 in South Temperate America; 60 in Australia and New Zealand; 40 in South Africa.

The following British plants are characteristic of the Arctic flora:—*Cerastium alpinum*, *Silene acaulis*, *Sibbaldia procumbens*, *Epilobium alpinum*, *Salix reticulata*, *Salix herbacea*, *Poa alpina*.

In Arctic Asia there is a marked scarcity of Monocotyledons, only from 40 to 50 out of a total of about 240 Arctic species being found there, and about half of these are grasses or

sedges. In contrast with this, the adjoining region, West Arctic America, contains between 50 and 60 grasses and sedges.

Out of 320 species belonging to the Greenland flora, all except 29 are European; of these 29 a few are endemic, the rest Asiatic or American. Several species present in Greenland are absent from East Arctic America. About 200 Scandinavian forms are absent from Greenland which are present in America. Several genera are absent from Greenland that are present in all the other Arctic regions, e. g., *Parrya*, *Astragalus*, *Valeriana*, *Androsace*, *Aster*, *Myosotis*, *Caltha*, *Rosa*, *Ribes*.

The following are some of the genera that form the chief part of the Arctic vegetation:—*Ranunculus*, *Saxifraga*, *Draba*, *Potentilla*, *Hieracium*, *Arabis*, *Gentiana*, *Veronica*, *Primula*, *Salix*, *Erigeron*, *Androsace*, *Juncus*, *Luzula*, *Carex*, *Poa*. No genus is restricted to the Arctic Regions proper, but several genera are peculiar to the Arctic zone and mountain regions taken together.

That the Arctic flora, though the youngest of floras, existed before the glacial period is proved by remains of plants identical with existing species found in strata near Cromer, and near Zurich a stratum occurs containing remains of the Arctic flora, where now the Vine and Chestnut grow. Fossil remains of Tree-ferns and other southern plants have been found in the far north.

Mr. Brown exhibited an interesting series of Arctic plants.

EVENING MEETING.—NOVEMBER 15TH, 1889.

Mr. R. Noakes presented twenty volumes of 'Science Gossip.'

Mr. A. J. Crosfield exhibited a living specimen of a Salamander, which he brought from Switzerland.

Mr. James B. Crosfield read the following note on a 'LUNAR RAINBOW AT REIGATE':—

On the evening of October 9th a remarkably fine lunar rainbow was seen at Reigate. The moon was full at 1.26 on the morning of the same day. At about 7.20 p.m. the eastern part of the sky was mostly clear, and the moon, not far above

the horizon, was shining brilliantly. In the west and south-west were some clouds; some light ones, radiating upwards from the horizon in the south-west, indicated the direction of the wind. At that time I first noticed the south-west end of the lunar rainbow, and for a few moments mistook it for another light cloud radiating from the same point. No rain was then falling. The rainbow very quickly increased in brightness and extent, until it formed a perfect arch from S.W. to N.E., and at about the same time rain began to fall. For about a quarter of an hour the rainbow was very brilliant, and formed a striking object; and some of the prismatic colours could be well distinguished, especially the purple and red.

Mr. C. E. Salmon then read 'NOTES FROM NORFOLK, 1889,' of which the following is an abridgment:—

During the latter part of June and the beginning of July we paid a short visit to Norfolk, making Cromer our headquarters. The Cromer cliffs are in some places almost covered with *Medicago sylvestris*, a rare plant in most places, but here growing most luxuriantly: it was in flower during the latter part of our stay, and we found specimens varying with yellow, pink, green, and purple flowers, all veined with streaks of the same colour, the green flowers being very inconspicuous.

At Ingworth, not far from Cromer, *Sedum rupestre* was found, but it was not then in flower. At the margins of sandy fields, on the top of the cliffs by the sea at Cromer, *Silene conica* grew. *Cerastium arvense* and *Anthriscus vulgaris* were plentiful about Cromer, although most of the latter was in seed; and *Cakile maritima* flourished on the shingle. One specimen only of *Orobanche cærulea* was found, but *O. minor* abounded in most fields, completely ruining the crop in some cases. *Smyrniolum Olusatrum*, the seeds of which turn black when ripe, was fairly plentiful, and *Borago officinalis* in one or two places; and in some lanes to the west of Cromer *Senecio viscosus* abounded.

In the salt-marshes near Weybourne the following plants flourished:—*Plantago maritima*, *Glauis maritima*, *Apium graveolens*, *Samolus Valerandi*, *Hordeum maritimum*, *Silene maritima*,

Aster tripolium, *Suæda maritima*, and *Cochlearia Danica*; and in a lane near here Henbane (*Hyoscyamus niger*) grew sparingly, while *Torilis nodosa* covered the hedge-banks. Another uncommon plant, *Sisymbrium Sophia*, we found at Sherringham, and later on about Cromer, but far more plentifully at the former place.

The Scale-fern (*Ceterach officinarum*) was noticed on an old wall at Weybourne, but only two plants; and *Parietaria officinalis* abounded in most places, while on the cliffs near Sherringham the Milk-thistle (*Carduus Marianus*) was growing to an enormous size. *Potentilla argentea*, too, was seen frequently in flower, chiefly delighting in dusty road-sides. Beeston Bog, about three miles from Cromer westwards, is a splendid place for water- and marsh-loving plants, and here we found the Common Butterwort (*Pinguicula vulgaris*) growing luxuriantly. Two other carnivorous plants were also pretty common, the Great and the Round-leaved Sundew (*Drosera anglica* and *rotundifolia*); the strength of the sticky tentacles of the former was very great, easily holding the House-fly and other large insects. Bog Pimpernel (*Anagallis tenella*) covered the ground with its delicate pale pink flowers, and here and there was a spike of *Epipactis palustris*. The Grass of Parnassus (*Parnassia palustris*) was also noticed coming up, and *Alisma ranunculoides* grew plentifully. Two other frequent plants about Cromer were *Carduus tenuiflorus* and *Salvia Verbenaca*, the former generally growing on the coast.

On June 26th an excursion was made to the Broads, and having taken a train to Wroxham, we walked to the River Bure, and hired a boat for the day. Proceeding down the river, we came to Wroxham Broad on our right, first exploring a marshy island between it and the Bure. On this island, which proved to be an excellent hunting-ground, we found *Lathyrus palustris* well in flower; *Thalictrum flavum* also grew on this island. Here, too, we discovered the following nests: Turtle Dove's, with two eggs; Wood Pigeon's, two eggs; Yellow Wagtail's, five eggs; and Reed Warbler's, five eggs, which were the only ones found during the day; the Turtle Dove's eggs were on the point of hatching, the beaks of the

young ones being just visible. Having rowed about Wroxham Broad for a short time, getting a good view of a pair of Great Crested Grebes, the eggs of which we were unfortunately too late for, we again entered the Bure, and, passing Hoveton Great Broad, which is private, we soon reached Salhouse Broad, where another pair of Great Crested Grebes were seen. Having left the boat, we started to walk across to Horning Ferry, about three miles distant, and soon came across a marsh where *Enanthe fistulosa* and *Comarum palustre* grew plentifully. Here, too, was seen one of our most splendid butterflies, the Swallow-tail (*Papilio Machaon*), sailing grandly by us; and we saw later on two more, one by Horning Ferry, the other near Ranworth Broad, but all these escaped us. Just before reaching Horning Ferry, in a stream, a quantity of Water Violet (*Hottonia palustris*) was found; here, too, the Water Soldier (*Stratiotes aloides*) was very abundant. The delicate flowers of the Frogbit (*Hydrocharis morsus-ranae*) also were plentiful; and *Stellaria glauca* occurred here, but was not very plentiful. The beautiful large yellow flowers of *Ranunculus Lingua*, growing to a height of 4 ft. or more, were very conspicuous, and enlivened the stream in many places. After a rather long hunt, one plant of *Liparis Loeselii* was found, and although a long time was spent in looking for more, no other specimens were discovered. At Ranworth Broad the Marsh Helleborine (*Epipactis palustris*) grew plentifully, and the Adder's-tongue (*Ophioglossum vulgatum*) also was abundant. Thousands of Black-headed Gulls were flying over Hoveton Little Broad, where they breed in vast numbers.

Of birds observed near Cromer, the only ones of note are a few Redstarts in a wood near there, some Herons at Salhouse, and a couple of Magpies hung up with Jays, Stoats, and Weasels, on a gamekeeper's tree near Hempstead. We also noticed a Snipe drumming or bleating above Beeston Bog, and it was interesting to notice that whenever it uttered its cry it spread out its tail and suddenly descended two or three yards in the air, but only to rise again, and, after flying some little distance, repeat the performance.

Mr. B. B. Gough read 'REPORT OF EXCURSIONS, 1889':—

April 27. — A large party went up the Water-tower near East Croydon Station. From thence the road led to Shirley Hills, and on to Addington Park. Here the Wood Wren was heard singing, and Green Woodpeckers were both heard and seen.

May 11.—The party, numbering about twelve, met at Box Hill, and, after walking some distance along the main road to Mickleham, turned along a footpath to the left, down which, after some trouble in climbing fences and other obstacles, they eventually reached the Mole. Here, in a hole in a tree, a Blue Tit's nest was found, containing two eggs. After walking some distance along the bank of the river, the members came to the so-called "Swallows," which are only deep hollows in the banks, and at that time of the year somewhat empty, but the water could be seen disappearing among the loose sandy soil. On the banks of the Mole, at Burford Bridge, the Broad-leaved Garlic was noticed in bud. Resuming the walk along the footpath, and passing Burford Bridge Station, the party made their way up to Ranmore Common, first visiting an old ruin, where a Pied Wagtail's nest was found, containing three eggs. Ranmore Common was next explored, and here a Pheasant's nest with twelve eggs was discovered. Butcher's Broom was noticed in flower in one or two places, but female ones only. Box Hill was next visited on the return, and *Monotropa hypopitys* was found in flower under the trees on the western slope. The Nightjar's notes were heard by the Box Hill Station, while the Turtle Dove and Corn Crake were often heard during the day.

May 25. — The party, consisting of fourteen members, met at St. John's Church, Redhill Common. They then proceeded over Earlswood Common, passing between the ponds. *Montia fontana* grew in the wet ditches. In the copse to the south of New Pond the trees were noticed to be greatly eaten by caterpillars, some of the Oaks being nearly stripped of their leaves. From Sidlow, as they walked along the river-side to Salford, the Garden Warbler was heard singing. Among the rushes were many newly-built nests of the Moorhen; in one of these

the materials used were the fresh flowers of Buttercups. Dragonflies were abundant, settling on the rushes by the water, especially the beautiful *Calopteryx virgo*, which has bands of deep blue on its wings. Some of the party had a good view of a Corn Crake, which was put up from some long grass and flew over the road. One plant of *Ranunculus parviflorus* was found growing on Redhill Common.

On June 8th an afternoon excursion to White Hill: ten members were present. Leaving Merstham Station, the party went through the meadows eastwards, then ascending on to the Upper Greensand the road was followed. *Lithospermum arvense* was noticed in a corn-field. Coming to the quarries below White Hill it was found that the entrance to the caves had been blocked. The party then ascended the hill, from which a fine view was obtained. Two plants of the Deadly Nightshade were found in flower. Some time was spent in the hilly fields behind White Hill. Several of the Orchid family were in flower, especially the Greater Butterfly Orchis, the Tway-blade, the Bird's-nest Orchis, the Large White Helleborine, and the curious Fly Orchis. On two specimens of the latter spiders were found, and it was suggested that they were attracted by the close resemblance of the flowers to flies. The Hautboy Strawberry (*Fragaria elatior*) was also found.

June 22. — West Wickham Station was the meeting place. Six members only were present. Passing the Manor House, which was built in the time of Henry VII., Hayes Common was reached. A Nightjar was seen to rise from the ground, and after a short search its two beautifully-marbled eggs were discovered, laid on a bare patch on the ground among the Bracken; the bird was heard churring not long afterwards, though during the middle of a hot summer day. Holwood Park, the property of Lord Derby, was next visited, and the members returned again over Hayes Common, where *Potentilla argentea* grew rather plentifully. A hen Redstart was also seen. The leaves of the Butterbur (*Petasitis vulgaris*) were plentiful by the road-side in one situation. The party returned from Hayes Station.

July 6.—After meeting at St. John's Church, a short time was spent on Earlswood Common, then crossing the railway some distance along the road brought the party to a turning on the right which led through meadows in which the hay had been recently cut, down to the river, the banks of which were gay with flowers. The river was followed as far as Mason's Bridge. The road was again followed until a footpath on the left took the party through the grounds of the Philanthropic Farm. Though the weather was fine, it was an uneventful excursion.

July 20. — To Leith Hill. The day was very wet, yet fourteen members started; some proceeded from Holmwood Station to the Common, others took the road through Broome Hall Park. Unfortunately the hill was shrouded in such a dense mist that the view was entirely lost. The way then led down one of the valleys that run north, following a small stream, then through the Duke of Norfolk's Park, and the beautiful Rookery estate. In the upper pond there stood a Heron up to its thighs in water. Four members walked in the afternoon from Dorking, through the Rookery to Leith Hill, and found *Mimulus luteus* by the pond at Westcott, where it has become naturalised. Two Yellow Wagtails were seen; also a young Lapwing at the foot of Leith Hill; while it was being examined, the parent birds flew anxiously overhead. Among plants were found Round-leaved Sundew, Bog Asphodel, Bog Pimpernel, and a white variety of Cross-leaved Heath; also the Lesser Dodder (*Cuscuta Epithymum*), covering large patches of Ling. A curious variety of the Foxglove was found, in which the lobes of each corolla (in the flower and bud) were slit up as far as the calyx, and a stamen protruded on each side. *Coronopus didyma* was found by Box Hill Station.

Aug. 10.—Excursion to Betchworth Hill. The party consisted of only seven persons, which was probably due to the threatening aspect of the weather. Those who risked this were, however, well rewarded, for it turned out a delightful afternoon, and the walk proved one of the most enjoyable of the afternoon excursions. The party quickly gained the open hill-side, working their way westward, and ascending, until Betchworth Clump was reached, whence a fine view was

obtained extending far over the country to the S.E., S. and S.W. Turning in a northerly direction away from the edge of the hills, the walk was continued by beautiful woodland paths to one of the valleys that run from Box Hill to Headley Lane, the one that is well known as the locality for *Teucrium Botrys*. The search for this plant proved, however, vain on this occasion. Many plants in this valley were growing with wonderful luxuriance, and the tall thick clumps of Ragwort formed very fine masses of colour. Plants of Hemlock were also observed growing to an unusual height. The party walked a mile or two up Headley Lane, and then turned to the right up a footpath that leads out into the fine open downs intersected with valleys that form part of Headley Heath. From here a tolerably direct course was taken to Betchworth Station.

On August 24th the excursion planned was rather further afield, and also somewhat longer than usual, the walk being from Eastbourne over Beachy Head, and along the cliffs to Seaford. The distance and the steady rain which fell from an early hour combined to deter members from venturing on this excursion, so that only three members started from Eastbourne Station. By this time the rain had ceased, the clouds rapidly broke, and the welcome sun shone brightly and very quickly dried up the wet ground. On the wide extent of shingle east of the town a considerable number of Ringed Plovers were observed, and their plaintive whistle was frequently heard. A few plants of *Lactuca saligna* were here met with growing in the shingle; this species has small inconspicuous dull yellowish flowers growing close to its woody stem, and exudes milk when handled. After passing the town and coming to the chalk-cliffs, the following plants were met with:—*Raphanus maritimus*, growing in abundance from the face of the cliff; *Lavatera arborea* in several places, but doubtless always escaped from the cottage-gardens near, in the hedges of some of which it had evidently been planted. On the grassy slopes leading up to Beachy Head *Spiranthes autumnalis*, *Phyteuma orbiculare*, and *Gentiana campestris* were abundant. A fine breeze from the west was blowing on the

top of the cliffs, and several squalls of rain could be seen a little distance out at sea; but though one of these skirted within two or three hundred yards of us, we happily escaped further rain. For several miles the walk along the edge of the cliffs is a constant succession of ups and downs, and along most of that distance the cliffs rise as a sheer perpendicular wall from the edge of the sea. The most interesting plant found during the walk was the rare *Erythræa capitata*, var. *β. sphærocephala*, specimens of which were gathered in two localities. To all outward appearance this species exactly resembles a dwarf form of the common Centaury (*E. Centaurium*). It may, however, at once be distinguished from this latter by having the stamens inserted on the receptacle, instead of at the mouth of the corolla. The only other locality known in this country is on the Freshwater Cliffs, Isle of Wight. About three miles before Seaford is reached the cliffs descend to the Cuckmere River, which has to be crossed by a boat. Ascending on the other side, the walk is continued along the cliffs for the remainder of the way. A rare umbelliferous plant, *Seseli Libanotis*, used to grow on the slope above the Cuckmere, but is probably eradicated, as no trace of it could be seen in the position described. Some fine specimens of Henbane (*Hyoscyamus niger*) were found in this part of the walk. A large number of Wheatears were seen in the course of the day, and a few Herring Gulls.

September 14. — An afternoon excursion. Some of the members started early, taking the train to Chilworth. *Polygonum dumetorum* was found in the steep lane from the station up on to Blackheath, festooning the hedges. From Blackheath, Ewhurst Mill was seen in the distance, the country between being undulating and for the most part covered with Pine-woods. Squirrels and Green Woodpeckers were in plenty, Pine-trees being their favourite resort. Patches of Rosebay Willowherb grew here and there on the dry sandy heath. The path then led to Farley Green. Overhead the Chaffinches were in full song. The forest land here is intersected by numerous valleys; up one of these, which led towards Ewhurst Mill, the party went. The boggy pieces of

ground on each side of the footpath were covered with the Lesser Skullcap (*Scutellaria minor*). Arrived at the top of the hill, a Leveret was seen running about in an open place among the trees; it allowed itself to be caught, but uttered loud screams until released. The party at length arrived at the high ground by Ewhurst Mill, then followed the footpath down another valley towards Gomshall, passing a colony of charcoal-burners in the Hurtwood. The road was followed through the village of Peslick to Gomshall Bog. Here a small flock of Goldfinches were feeding on the Thistle-seeds. A single plant of the Annual Mercury was found by the Station, also *Diplotaxis muralis*. The rest of the party arrived about half-past three. Some time was spent in the marshy part of Gomshall Common, but no special objects of interest were found.

September 28. — Two of the members starting early, took train to Balcombe, and walked across through Ardingley to West Hoathley, passing on the way large masses of rock composed of the Hastings Sand. On the hedge-banks the following spring flowers were noticed:—Wood Strawberry, Strawberry-leaved Cinquefoil, Garlic Treacle-mustard, and *Viola Reichenbachiana*. Wood Pigeons had assembled in large flocks. The rest of the party arrived about ten o'clock at West Hoathly Station. The excursion was then directed to Ashdown Forest. On the sides of a stream *Campanula hederacea* was found in flower. The *Sphagnum* Moss was deeply tinged with red; among it grew Sundew and Bog Asphodel, both in seed, also Club-moss. Some pits were passed where the Hastings Sand was being quarried. Several of the party visited the picturesque ruins of Bramble-tie House, close to Forest Row Station.

October 12.—In search of Fungi. Six members only constituted the party. As permission could not be obtained to visit Tilgate Forest, the members proceeded from Crawley Station to St. Leonard's Forest. Fungi were not so abundant as might have been expected from the late dampness of the weather. 103 species of plants were found in flower, including *Campanula hederacea*, *Geranium pyrenaicum*, and a single flower

of Dog Rose. The cry of the Green Woodpecker was frequently heard in the more wooded parts of the Forest, and occasionally one or two might be seen. A farm-house and several ruined cottages were passed, which had been deserted owing to the poverty of the soil. The party then walked in the direction of the tower at Forest Lodge, and joined the main road. From the top of the tower a good view was obtained, looking over the Forests of Tilgate and St. Leonard's, stretching to the South Downs, and to Hindhead to the W., Leith Hill and Ewhurst Mill to the N.W., also to Betchworth, Reigate, and White Hills. From the tower the road was followed down to Fay Gate Station. Here *Diplotaxis muralis* was found.

Mr. J. B. Crosfield exhibited specimens of a rare Fungus, *Tremellodon gelatinosum*, found by Mr. E. S. Salmon at Crockham Hill, near Edenbridge.

Mr. W. F. Tindall exhibited a specimen of the Ring Ousel, which was killed, on September 26th, on Headley Heath.

Messrs. E. S. and C. E. Salmon exhibited beautifully-mounted specimens of most of the plants referred to in the papers read.

EVENING MEETING.—DECEMBER 20TH, 1889.

The Secretary read a paper by Mr. Alfred B. Gough, entitled 'NOTES ON BRITANNY AND JERSEY':—

On the 31st of July last we left Southampton for St. Malo. We stayed in St. Servan, which is close to St. Malo, for nearly a month. The ancient city of St. Malo is built on a small island connected with the mainland by a causeway. It is surrounded by an enormously thick wall. The whole of the neighbouring coast is very rocky, there being some scores of islets off St. Malo, which make the sea-views very picturesque. Two or three of these rocks are fortified. The coast is skirted by low cliffs for some miles, until on crossing a promontory the vast expanse of St. Michael's Bay appears

spread out below one's feet. At the little village of Caucale, at the foot of this promontory is an Oyster-park; there are numbers of square enclosures made with wood, containing the Oysters, and these are covered by the sea every high tide. In the distance, from the hill above this village, may be seen two rocky islands in the bay, Mont St. Michel and Tombelaine. We spent two days at the former, which is a most interesting place, but of course chiefly on account of its antiquities. The bay, which is from fifteen to twenty miles across, is laid bare to a great extent at low water. The tide in the bay retires eight or ten miles, leaving sands, over which may be seen long strings of horses and carts guided by men who run in front barefoot. The sands are very treacherous in places, and persons have often lost their lives in them. It is a wonderful sight to see the tide rushing in—it is said faster than a horse can gallop.

Mont St. Michel is an isolated pyramidal rock, rising out of the sand, nearly a mile from land, but joined by a causeway. The extreme width is only 900 ft., and the height of the summit of the buildings (from which there is a grand view) 470 ft. above the sea. A beautiful wild Pink (*Dianthus caryophyllus*) grows in graceful tufts all over the rocks and the old walls; it is very sweet-scented; with it is the common Scale Fern (*Ceterach officinarum*) in luxuriance.

St. Malo is at the mouth of the River Rance, which is tidal for about nine miles. The river varies greatly in width. At one place the rocks leave only a narrow passage of a few yards, at others it is nearly half a mile wide. The water swarms with Jelly-fish, which can be clearly seen slowly swimming along, by contracting and expanding their delicate bells edged with purple. Several Sandpipers and Kingfishers were also seen; the Kingfishers both here and in Jersey were seen to frequent the rocks by the tidal river or sea-shore.

By the river-side near St. Servan we found the following plants:—*Anchusa italica*, with splendid clusters of bright-blue flowers; and on the rocks a tall pink *Allium*, Madder, Portland Spurge, *Hypericum Androsæmum*, Butcher's Broom, *Iris fœtidissima* (with its scarlet seeds), and Fennel. Humming-

bird Hawk Moths were abundant on these cliffs, and one specimen of the Lulworth Skipper Butterfly was seen.

Our best walk was when we crossed the Rance by the ferry to Dinard, and walked along the cliffs by the sea, where we found the Autumnal Squill, with its little lilac flowers as yet without leaves, and with them the pink Garlics, and the inconspicuous flowers of the Proliferous Pink (*Dianthus prolifer*) opening one at a time. Further on a flock of Tree Sparrows was seen. In a salt-marsh *Triglochin maritimum* grew. We then turned inland into a wooded district, with fields of the sweet-scented Buckwheat, then one mass of pink bloom, with deep-red stalks. The meal obtained from the seeds of this plant furnishes the chief food of the peasantry; these patches of Buckwheat in the open spaces were very attractive to the Silver-washed Fritillaries. In a similar spot another day we caught Brown and White-letter Hairstreaks (*Thecla Betulae* and *W-album*). We now came into a swampy forest full of the beautiful Ciliated Heath; with it grew *Bartsia viscosa*, *Galeopsis speciosa*, and the pale-blue spikes of the acrid *Lobelia*, noted for its irritating flavour. Some large dull-red Slugs were found, which on the under side were of a fine scarlet colour. In this forest, another day, we found the beautiful little Ivy-leaved Bell-flower in great abundance.

One of the chief features of the neighbourhood is the abundance of stone walls. The walls and thatched roofs were covered with *Orobanche*, *Cotyledon umbilicus*, *Centranthus ruber*, *Sedum anglicum* and *S. rupestre*, *Polypodium vulgare*, and *Fumaria paleiduliflora*, in great abundance, with its cream-coloured flowers tipped with purple. These walls were frequented by great numbers of Lizards, which were often seen running up the almost perpendicular surface, and by a brilliant species of Tiger Moth, of which we caught one specimen in which the scarlet was replaced by yellow.

The waste ground around St. Malo Harbour was covered with *Diplotaxis tenuifolia*, *Melilotus leucantha*, the handsome grass, *Polypogon Monspeliensis*, and the curious Star-thistle, *Centaurea calcitrapa*. Other interesting plants were the delicately-pencilled Lilac Toadflax, *Linaria Pelisseriana*, a

small *Campanula* something like the Harebell, the Deptford Pink (*Dianthus armeria*), and the little yellow *Lathyrus aphaca*. Birds were rather scarce, one of the commonest being the Magpie, much tamer than in this country; it seemed to take the place of the Rook, which we scarcely ever saw. Goldfinches and Gird Buntings were also common. Other birds noted were the Curlew, and perhaps the Cormorant. We were told that the Golden Oriole bred sometimes in a wood near St. Servan. During the month we saw about fifty species of birds in France.

On August 20th we paid a visit to Jersey, stopping there three nights. On the passage two very distinct rainbows were seen continuously in the spray around the bows. As our time was so short, we confined ourselves almost entirely to the western half of the island, which is the more interesting. Jersey is twelve miles by six. No part reaches a great elevation, though it is all hilly. The rocks are mostly igneous, and form fine cliffs. On some inaccessible parts of these cliffs there is a colony of Goats, which have escaped and returned to a wild state. We visited two large quarries of the granite, of which much of Jersey is composed. At St. Brelade's Bay there is a deep fissure in the rock, only about five feet wide, which leads into a cave said to be about a mile long. The south side of the island is extremely fertile and warm, owing partly to the fact that a range of hills runs along the north side E. and W., and rich soil is carried down their southern slope by numerous little streams. The steep northern face of these hills is heath-clad, and very wild and uncultivated; in fact, scarcely a house can be seen for miles. The west coast of Jersey seems to produce most wild flowers. In the centre of St. Ouen's Bay is a large fresh-water pond surrounded with sand-hills. On a walk thither from St. Aubin's we found the following plants:—*Echium plantagineum* (or *violaceum*) in abundance, the yellow Wood Sorrel (*Oxalis corniculata*), the Tree Mallow (*Lavatera arborea*), *Euphorbia Lathyris* and *Paralias*, the diminutive *Rosa spinosissima*, then in berry, which covered the ground in some places; the Autumnal Squill, with a white variety; *Silene nutans*, in seed,

in great abundance on old walls; *Polycarpon tetraphyllum*, a rare and inconspicuous little plant, grew near the pond, along with the fragrant *Matthiola sinuata*, a species of Stock with downy leaves and purple flowers, the Sea Radish, the rare species of Thrift (*Armeria plantaginea*), with long bracts, covering acres of ground, and the pretty Hare's-tail Grass (*Lagurus ovatus*), in a large patch. Along the bay were many stacks of Sea-weed, or "vraic," as it is called, which the inhabitants are only allowed to collect at certain times for manure. In the pond grew *Alisma ranunculoides*, *Samolus Valerandi*, and by the edge a rare Rush (*Scirpus punjens*) and *Spiranthes autumnalis*. This pond is a locality for the much rarer species *astivalis*, only found in one or two localities in England, and very much like the common one. In some heaps of stones three specimens of the beautiful Green Lizard (*Lacerta viridis*) were seen, but could not be caught, owing to the rapidity of their movements. They are much larger than the Common Lizards, and extremely handsome, being a most vivid green colour, with black marks. This Lizard is said to be readily tamed; it is rarely seen in this country.

Several interesting plants were found on the shores of St. Helier's Bay. Evening Primroses were in great plenty on sand-hills near the water's edge close to the railway; with them grew *Alyssum maritimum*. In St. Peter's Marsh a curious variety of the common Ribwort Plantain was found, with a long stalk bearing a head of leaves and flowers. It was not noticed whether there were any root-leaves. Near the district of Quenvais the following were growing:—*Dianthus prolifer*, *Linum angustifolium*, and Soapwort with double flowers. We were told by an inhabitant of the island that in a wood at the back of St. Aubin's there was formerly a colony of Crows, but that the Magpies and Jays had driven them away.

Specimens of many of the plants named in the paper were exhibited.

Mr. W. H. Tyndall read a paper on 'EARTHQUAKES.' The following is an abridgment:—

Among the terrible visitations to which this earth is liable,

earthquakes probably are the most terrifying in their effects, especially when the convulsions are violent. Earthquakes are of more frequent occurrence than might at first be supposed. In Palermo fifty-seven earthquakes occurred in forty years, each one thoroughly noticeable by a casual observer: that is, nearly three convulsions in every two years. In the town of Copiapo, in the northern province of Chili, earthquakes are of almost daily occurrence, but only occasionally of a force sufficient to create much damage. The inhabitants accustomed to these visitations, at the first notice of them, if in the day-time, rush out of their houses, and thus, when the shocks are of sufficient force to throw down buildings, save their lives. When the shock comes in the dead of night, the danger to the people is of course so much greater.

If we could obtain accurate accounts from all parts of the world, it is not at all improbable it would appear that some portions of the earth's surface are in movement every day, so that the surface as a whole is never entirely at rest. Some districts are, however, much more subject to earthquakes than others; but the phenomenon is found in all countries—among mountains, on the low lands, and in plains at high-level. Sometimes when the plain is violently disturbed, the neighbouring mountains feel no shock, or again, when the mountains are convulsed, the plain is left undisturbed; at other times the whole district, whatever the character of the country, is subject to the disturbance.

It does not appear that the geological structure of the country has much, if any, influence on the occurrence of earthquakes. They occur among the formations of the primitive rocks, and in the districts of post-tertiary deposits; in the low-lying plains of the Scheldt and the Mississippi; and in the tertiary deposits of our own country, as may be remembered in the instance of the earthquake in Essex in the year 1884, when 31 places of worship and 1300 buildings were damaged. Slight shocks of earthquakes have not unfrequently been felt of late years, and perhaps in former days, in Wales and in Devonshire. The neighbourhood of Crieff, in Scotland, is very liable to earth-disturbances, but they are

not severe. Nor, in fact, have the earthquakes in Great Britain ever been very severe, that in Essex, before referred to, being the most severe of modern times.

Those countries situated in the vicinity of volcanos are not, as a consequence of such proximity, liable to severe earthquakes. Slight disturbances of the earth's surface do sometimes arise when a volcano is in violent eruption, but those disturbances are usually the effect of detonations in the volcano, and are not strictly earthquakes in the sense in which that phenomenon is usually understood. But it has been observed that when a volcano hitherto in continuous eruption suddenly ceases its eruptive force, a true earthquake not unfrequently follows, and the inhabitants of the district regard this cessation of the eruptive force as a sign that an earthquake may be expected. It seems that the ordinary mode of escape of the internal forces of the earth in that district through the action of volcano being from some cause interrupted, a vent is found in the action of an earthquake.

In the year 1812 the extensive plains of the Mississippi were subject to earthquakes during the greater part of the whole year, no volcano, however, being nearer than many hundreds of miles. That part of Asia lying between the Euphrates and the eastern shore of the Mediterranean is very subject to earthquakes of great violence, but there is no volcano anywhere near. Copiapo, in South America, so subject to earthquakes, is 250 miles from the nearest volcano. The disastrous earthquakes of Calabria, in 1783, of Riobamba in the Andes, in 1797, and of Molese in the Kingdom of Naples, in 1805, were not within 100 miles of a volcano.

Earthquakes are more frequent in countries approximate to the sea than in those countries far inland. Thus on the old Continent, the regions of the north and eastern shores of the Mediterranean, and the north-western coast of Africa are subject to these convulsions. Nearly the whole of the western coast of America from 60° N. lat. to Cape Horn may be regarded as an earthquake district. Many of the islands of the Eastern Archipelago, the north-western part of Australia and the northern island of New Zealand, the Japanese Islands,

and the Peninsula of Kamtschatka, are also liable to these convulsions. The seaboard is not, however, the only district liable to earthquakes. Persia, India (more especially the northern part), and the district known as Central Asia, are subject to violent earth-disturbances, extending even so far as Eastern Siberia.

The mischief done by an earthquake is not always to be measured by the *violence* of the shock. There are shocks of different kinds, chiefly four kinds—tremulous, undulating, upheaving, and rotatory.

The *tremulous* shocks appear to be the least destructive. They are common along the Pacific coasts of South America. They usually pass away quickly, but sometimes last for several days. In 1816 the town of Sciaca, in Sicily, was shaken for several days by tremulous shocks. The tremor resembles a heavily-laden wagon passing over a hard, rough, and rocky roadway.

The *undulating* shocks are much more destructive. The ground moves horizontally backwards and forwards, and the motion of the earth not being readily communicated to tall buildings, they totter and fall. This undulating motion produces what are termed smart shocks.

Upheaving shocks are still more disastrous, and are greatly to be dreaded. The force opens the surface of the earth, making chasms sufficiently wide to engulf men, animals, furniture, and houses. Such appears to have been the kind of shock in the great earthquake of Calabria on 28th March, 1783. The ground was seen to rise and fall rapidly. Persons were raised from the ground, and thrown to some distance; houses were removed from their site, and carried to higher elevations. In S. America, after the great earthquake of Riobamba in 1797, corpses were found on the top of a hill several hundred feet higher than the city whence they had been shot by the violence of the concussion, at least so it is reported. Upheaving shocks are almost always accompanied by an undulatory motion, hence to some extent is the increased danger of these convulsions.

Rotatory shocks are the most destructive of all, but they

occur most rarely: they affect the earth with a whirling motion, resulting from a combination of the undulating and upheaving motions, or perhaps by undulatory motions crossing each other at an angle, somewhat resembling the action of a cross sea. In the earthquake of Catania, in 1818, several statues were turned round; and portions of rock had their directions changed from north and south to east and west. In the earthquake of Valparaiso, in Chili, in 1822, the church of La Mercea presented a most remarkable ruin; the tower was built of bricks, with walls six feet in thickness up to the belfry; the walls were shivered into blocks, and thrown down. On each side of the church were buttresses of solid brickwork also six feet in thickness: those on the western side of the church were all thrown down, as were all but two on the eastern side, and those two were twisted round, presenting the angle of the buttress to the wall of the church, instead of the square side of the buttress. In an earthquake in Chili, in 1835, an angular stone pinnacle had been turned half round without being thrown down from its base, and this could have been done only by a rotatory motion of the earth. In Calabria a plantation of Mulberry-trees was carried into the middle of a corn-field and left standing there, and a piece of ground sown with Lupins was forced into a vineyard. The changes of ground which occurred after this earthquake were the causes of numerous law-suits as to the possession of property, the boundary-marks being removed or altogether obliterated.

Humboldt records an extraordinary fact. While surveying the ruins of the destroyed town of Riobamba, in S. America, for the purpose of making a map, he was shown a place where the whole furniture of one house was found buried beneath the ruins of another house. The ground seems to have been moved first downwards, then horizontally, and subsequently upheaved into its new position.

There are districts in South America which never experience shocks of earthquake, although the countries lying all round them are subject to such visitations. The cause of this exemption is not known. The inhabitants of those districts

say that the shocks pass under them at such a distance below that they are unaffected by them, but that beyond or outside those exempted districts the causes of the shocks rise nearer to the surface of the earth, and break through the thinner crust of the earth.

Earthquake-shocks are propelled often to a great distance from the centre of convulsion. Humboldt estimates that the concussion travels at the rate of between twenty and thirty miles a minute, losing force on its journey. The convulsion is propagated very much after the mode of propagation of a wave caused by throwing a stone into a lake: the nature of the crust of the earth causing some variation in the direction of the wave and in the force of the convulsion, the force diminishing as the distance from the centre increases.

When the distance is so great that the solid surface of the earth is unaffected, the surface of the ocean and of inland lakes is not unfrequently affected. Water will rise or fall above or below the ordinary level. Springs are stopped or in some cases burst forth with increased energy. In the case of a great earthquake in Peru, in 1868, the ocean-waves produced by the convulsion were propagated so far as Australia and New Zealand.

The earthquake which convulsed Calabria in so frightful a manner did not extend its influence to a great distance from its centre, but the earthquake of Lisbon was traced over a space of about fifteen millions of square miles, equal to one-twelfth of the area of the globe. The effect of this earthquake crossed the Atlantic, and influenced several of the Windward Islands of the West Indies, and Trinidad. It was also felt in the North-eastern States of America, and in Canada.

Although a subterranean noise usually precedes or accompanies a convulsion, it does not always do so.

On the occasion of some earthquakes, longitudinal chasms have been formed in the earth, usually of no great width, but often many yards in length; when numerous, they occur in parallel lines. On an occasion of an earthquake in Italy, the inhabitants, seeing this character of the chasms, felled trees and threw them across the openings; thus many persons

saved their lives from being engulfed when the chasms subsequently closed.

One of the most destructive phenomena connected with earthquakes is the rising of the sea. After the earthquake at Lima in 1746, the sea at the port of Callao rose eighty feet, and, rushing over the town, destroyed nearly the whole of it, drowning the greater number of the inhabitants. At an earthquake occurring at Concepcion, in South America, in 1835, several vessels were lying in the harbour, when many great waves swept into the harbour, wrecking some ships, and carrying others inland, leaving them ultimately high and dry. Two vessels were at anchor, lying side by side; when the waves had ceased, it was found that the cables were twisted together with three turns, so that the vessels must have been carried round each other three times.

Whether the land is ever permanently raised by earthquakes is a disputed question. It has been asserted that by the earthquake of Valparaiso, in 1822, the land on the western shores of S. America for a distance of about fifty miles had been raised three feet. It is pretty certain that in the district of Cutch, in N.W. India, by a convulsion which occurred on June 15th, 1819, a district containing about sixty square miles was lowered so as to form a great lake over which boats could sail. It is said also with some fair show of evidence that adjoining land to an extent of about 750 square miles was raised ten feet, so as to alter the course of the River Indus, which, however, in after years broke the barrier, and formed a new channel into the sea.

RULES.

NAME.

I.—The Association shall be styled "THE HOLMESDALE NATURAL HISTORY CLUB."

OBJECTS.

II.—The investigation of the Natural History of Reigate and its vicinity, and the mutual improvement of the members in the study of Nature.

CONSTITUTION.

III.—The Club shall consist of Members, Subscribers, Corresponding Members, and Honorary Members.

MEMBERS.

IV.—Members shall be elected by ballot or show of hands at any Ordinary Meeting. The candidate to be recommended by one or more Members at any Ordinary Meeting, and the election to take place at the Meeting next ensuing.

SUBSCRIBERS.

V.—Subscribers shall be elected in the same manner as Members, and shall have all the privileges of Members, except of holding any office in the Club, or of voting upon any matter connected therewith, or of having any right or ownership in the property of the Club.

CORRESPONDING MEMBERS.

VI.—It shall be competent for the Club to elect as Corresponding Members any gentlemen distinguished for their attainments in Natural History, either as collectors or authors, or to whom the Club may be indebted for contributions of papers or specimens; such Corresponding Members to have similar privileges to Subscribers without payment, and to be elected by the Club upon the nomination of the Committee.

HONORARY MEMBERS.

VII.—Honorary Members shall be elected by the Club upon the nomination of the Committee; and shall be exempted from the payment of subscriptions, and shall have the privileges of Subscribers.

OFFICERS.

VIII.—The Club shall, at the Annual General Meeting, elect from among themselves a President, Treasurer, Secretary, Curator, and nine Members to form a Committee of Management, three of whom to form a quorum.

VICE-PRESIDENTS.

IX.—The President shall nominate annually two Vice-Presidents from the members of the Committee.

ANNUAL GENERAL MEETING.

X.—This shall be held previous to the Evening Meeting on the third Friday in October, when the Committee shall present a Report detailing the general state, proceedings, and pecuniary condition of the Club, and proceed to the election of officers.

SPECIAL MEETINGS.

XI.—The Committee shall have the power to call a Special General Meeting at any time; and they shall do so within four weeks after receiving requisition to that effect, signed by at least five Members. The notice calling the Meeting shall state the objects for which the Meeting is called, and no other business shall be transacted.

ORDINARY MEETINGS.

XII.—These shall be held on the third Friday in every month, from October to April inclusive, or more frequently at the option of the Committee.

SUBSCRIPTIONS.

XIII.—Each Member shall pay to the Treasurer Ten Shillings on his election, and the same sum at the Annual General Meeting each year; but may compound for such Annual Subscription by payment of Five Pounds. Each Subscriber shall pay to the Treasurer Five Shillings on his election, and the same sum at the Annual General Meeting each year. That it shall be optional with the Committee to strike out the name of any Member or Subscriber who shall be in arrear with his Subscription for twelve months or more.

NEW RULES.

XIV.—Any five members wishing to propose a New Rule, or the omission or alteration of any existing Rule, must send notice to the Secretary, who shall within a month call a Special General Meeting to consider the change proposed.

LIBRARY AND COLLECTIONS.

XV.—The Club shall form, as opportunity may offer, a Library of Reference, consisting of works bearing on the subject of Natural History; and obtain collections of the natural objects of the neighbourhood. The Library, Collections, and Funds to be the property of the Members for the time being, and shall be vested in Trustees for the use of the Members. Contributions of Life Members shall also be invested in the names of such Trustees in such manner as the Committee may direct, the interest arising therefrom to be handed to the Treasurer for the general purposes of the Club.

ELECTION OF TRUSTEES.

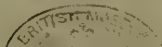
XVI.—The Trustees shall consist of the President for the time being, and three other Members to be elected by the Club.

LIST OF MEMBERS AND SUBSCRIBERS.

*Names marked * are Honorary Members.*

- ADENEY, Miss; Bushey, Reigate.
ASHBY, EDWIN; Adelaide, S. Australia.
ASPLAND, THEOPHILUS L.; Deepdale, Reigate.
ASPLAND, Mrs. T. L.; do.
BARCLAY, Miss MARION F.; Hillside, Reigate.
BAXTER, ROBERT C.; Hethersett, Reigate.
BEEBY, W. H.; 14, Ridinghouse Street, London, W.
BINNS, RICHARD; Lovelands, Reigate.
BONNER, JAMES; Linkfield Lane, Redhill.
BOSSEY, FRANCIS, M.D.; Mayfield, Redhill.
BRASS, Rev. HENRY, M.A.; Redhill.
*BROWN, N. E.; Herbarium, Kew.
CAREY, FREDERICK GEORGE; Kent House, Addiscombe, Croydon.
COOMARA-SWAMY, Lady ELIZABETH; St. Alban's Lodge, Reigate.
COOPER, THOMAS; Brighton Road, Redhill.
CROSFIELD, JAMES B.; The Dingle, Reigate.
CROSFIELD, HERBERT; do.
CROSFIELD, Miss; do.
CROSFIELD, ALBERT J.; Carr End, Reigate.
CROSFIELD, Mrs. A. J.; do.
CUDWORTH, JAMES I.; Woodcote, Reigate.
CUDWORTH, Mrs. J. I.; do.
DUNCAN, WILLIAM A.; Woodlands Road, Redhill.
*EVELYN, W. J.; Wotton House, Dorking.
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FERNELEY, CHARLES A.; High Street, Reigate.
FIELD, Miss; Brooklands, Redhill.
GABELL, ALVERSTONE, L.D.S.; Station Road, Redhill.
GILFORD, WILLIAM; Beech Grove, Redhill.
GOUGH, ALFRED B.; Sandcroft, Redhill.
GOUGH, BERNARD B.; do.
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HEATON, WILLIAM H.; Inglewood, Reigate.

- HESKETH, R. L.; Ringley Mead, Reigate.
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 HORNE, Miss; Warwick Road, Redhill.
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 LEES, JOHN; Reigate.
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 PAWLE, FREDERICK C.; Northcote, Reigate.
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 POWELL, Dr. F.; Hatchlands Road, Redhill.
 RICHARDS, Mr.; Garlands Road, Redhill.
 ROSLING, HENRY; Alders Road, Reigate.
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 SELLS, VINCENT P.; Linkfield Lane, Redhill.
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 STERRY, ARTHUR C.; Heatherlea, Redhill.
 STERRY, Miss Ida S.; do.
 STERRY, JOHN; Earlswood Road, Redhill.
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 TYNDALL, Mrs. W. H.; do.
 WALDUCK, CHARLES E.; 2, Lansdowne Road, Lee, Kent.
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 WATNEY, DANIEL; 33, Poultry, London, E.C.
 WEBB, HENRY; Redstone Manor, Redhill.
 WEBB, SYDNEY; Maidstone House, Dover.



PROCEEDINGS
OF THE
HOLMESDALE NATURAL HISTORY CLUB

FOR THE YEARS 1890, 1891 & 1892.

TOGETHER WITH
RULES AND LIST OF MEMBERS.



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Honorary Secretary:

ALBERT J. CROSFIELD, *Carr End, Reigate.*

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PROCEEDINGS
OF THE
HOLMESDALE NATURAL HISTORY CLUB.

EVENING MEETING.—JANUARY 17TH, 1890.

Mr. W. H. Tyndall read 'METEOROLOGICAL NOTES, REDHILL, 1889':—

BAROMETER.—There have been no excessive variations of the barometer. The maximum occurred on the 4th of January, when it reached a height of 30·66 in. The minimum was on the 20th of March, when it fell to 29·05 in. On 192 days it reached 30 in. and upwards; on 173 days it fell below 30 in. The highest average of the month was in November, being 30·22 in.; the lowest average in October, being 29·72 in. In October it rose to 30 in. on three days only; in January it rose to 30 in. and upwards on 23 days.

THERMOMETER.—The range of the thermometer during the year has been $70^{\circ} 5'$, being $85^{\circ} 50'$ on the 1st of August, and 15° on the 12th of February. It fell to freezing and below on 75 days; rose to 70° and above, but under 80° , on 63 days; rose to 80° and upwards on 5 days. This result shows fewer frosty days, and more warm days, than in 1888. In that year there were 91 frosts; only 28 days on which the thermometer reached 70° and was under 80° , and only 3 days on which it reached 80° and upwards; the maximum being 82° on the 25th of June. Upon the whole, 1889 was warmer than 1888. On 5 days only did the thermometer fail at some portion of the day to rise above the freezing point—on the 1st, 5th, and 6th of January, on the 25th of February, and on the 3rd of December. On many other days the *ground* continued frozen

after the temperature of the air had risen above the freezing point.

RAIN to the extent of $\cdot 01$ of an inch and upwards fell on 178 days. I have recorded only 177 days, for on the 25th of July the gauge was upset, and the rain lost. The total collected on those 177 days was $27\cdot 24$; but I judge from the appearance of the ground on the morning of the 25th of July that about one-fifth of an inch had fallen in the preceding 24 hours. The average fall for the last 22 years is $30\cdot 86$ in., so that the season of 1889 may be regarded as dry. The average number of days on which rain fell during the same period is 177 days. The rainfall, so far as regards the number of days, is close to the average. There were 11 intervals of six days and upwards continuously on which no rain fell, the longest period being 23 days, from the 16th of June to the 8th of July; and there were 6 intervals of 6 days and upwards continuously on which rain fell on some part of the day, the longest period being 12 days, from the 21st of April to the 2nd of May. The wettest month was October, in which month $5\cdot 17$ in. fell; the driest was June, in which $\cdot 80$ of an inch fell. Less than an inch fell in September, being $\cdot 96$. The heaviest fall was $1\cdot 15$ of an inch on the 7th of March; the next $1\cdot 02$ of an inch on the 19th of August. There was a continuous fall on the 26th and 27th of May, when $\cdot 97$ of an inch fell on the two days; beyond these instances no very heavy fall occurred.

SNOW fell on the 10th of January, and in February on the 10th, and again each day from the 23rd to the 28th; but it was not until the 27th and 28th that it fell heavily, but even then not very heavily. Some snow fell on the 2nd to 5th of March. A little snow fell on the 27th of November, but not sufficient to record as to quantity, and again on the 6th of December, when the amount of snow was equal to $\cdot 80$ of an inch of rain.

On the 2nd of February a combination of snow and hail fell to the extent of one-fifth of an inch. A little hail fell on the 30th of May, but not sufficient to record the quantity.

THUNDER was heard about 4.30 p.m. during a heavy shower

on the 9th of April, and again on the 22nd of April. With lightning, thunder was heard about 3.30 p.m. on the 30th of April, rain falling. Thunder was heard between 3 and 4 p.m. on the 5th of May, again on the 2nd of June about 5.25 in the afternoon, and on the 17th and 27th of July; on the latter date rain fell. Lightning was seen and thunder heard on the 2nd of September, with a little rain, from 8 to 9 p.m.

A faint Aurora was seen about 9.30 p.m. on the 28th of January.

There have been strong breezes occasionally, but no heavy gales of remarkable character, but on the 25th of June, about 1.30 p.m., a strong whirlwind was felt at Nutfield, which carried portions of hay a distance of more than a quarter of a mile, from the valley below to the top of the hill.

Upon the whole the report of the Meteorology for Redhill for the year 1889 is rather tame, a result favourable to the inhabitants, but presenting no circumstances of great import.

Mr. James B. Crosfield compared the Meteorological returns from the London district, from which it appeared that during 1889 there were 5 more rainy days in London than at Redhill, though the total fall in London was only 24.7 in. against 27.24 in. at Redhill. The minimum temperature for the year in London was 20°, against 15° at Redhill.

Mr. James B. Crosfield read the following paper on the 'NESTING OF THE KENTISH PLOVER':—

In the course of an excursion to Dungeness, accompanied by three other members of the Club, on the 18th of May last, we were fortunate enough to find two nests of the Kentish Plover, and as this species is so very local in this country, apparently only occurring habitually on the coasts of Sussex and Kent, it may be interesting to record a few particulars. On this and previous excursions the birds had been frequently observed, and though on some of these occasions I had spent a good deal of time in searching for their nests, it had hitherto been always in vain. The immense area of level shingle, which is the favourite resort of this species, seems, by its very extent, to render the discovery of so inconspicuous

METEOROLOGY. -- OXFORD ROAD, REDHILL, SURREY (1889).

Month.	BAROMETER.				THERMOMETER.						RAIN.	
	Max.	Date.	Min.	Date.	Max.	Date.	Min.	Date.	Average.		Mean.	Total of No. of Days Month. .01 fell.
									Max.	Min.		
Jan. .	30.66	4	29.37	10	52.0	27 & 31	19.5	5	40.74	32.79	36.77	11 INCHES. 1.68
Feb. .	30.44	18	29.48	7	56.5	17	15.0	12	41.98	30.61	36.29	22 3.10
March	30.50	15	29.05	20	57.0	29	18.0	3	46.78	32.71	39.74	18 2.61
April.	30.24	19	29.30	4	63.0	19	31.5	15	52.87	38.25	45.56	22 2.53
May. .	30.15	21	29.59	25	80.5	23	39.5	1	66.44	48.77	57.60	11 2.12
June .	30.35	30	29.65	10	81.0	28	44.0	17	71.28	51.40	61.84	5 0.80
July .	30.46	2	29.10	27	79.0	30	45.0	22	70.97	53.23	62.10	13 2.10
Aug. .	30.27	27, 28	29.34	20	85.5	1	43.5	26	69.35	51.18	60.27	15 3.02
Sept. .	30.45	16	29.61	24	78.0	12	34.5	16	64.57	47.40	55.98	9 0.96
Oct. .	30.21	25	29.20	19	59.5	16	33.0	13, 31	54.72	41.05	47.89	24 5.17
Nov. .	30.65	18	29.48	25	58.0	15	24.0	30	49.15	37.72	43.43	9 1.10
Dec. .	30.57	26	29.42	11	51.0	17 & 22	20.0	28	41.77	31.97	36.87	19 2.10
Year.	30.66		29.05		85.5		15.0				48.65	178 27.24

a nest very improbable. Walking southward along the coast from New Romney to the point of Dungeness, my eye all at once rested on three eggs among the shingle, and I instantly perceived they were those of the Kentish Plover. Just as when I first made the acquaintance of the birds some years ago, I found them more readily distinguishable from their near relative the Common Ring Plover than I had expected would be the case, so now I found a greater difference between the eggs of the two species than I had supposed. The nest consisted merely of a little wiry dry grass in a slight depression among the shingle. The eggs, only three in number (instead of four, the number almost invariably laid by the Ring Plover), were not arranged with their small ends together according to the habit of that species. As might be expected from this circumstance they were also less pointed at the small end. The ground colour was more olive, and of a darker shade, and the markings were more scrawly. I took one of the eggs, and found on blowing it that it was almost fresh. From one-quarter to half-a-mile further along the beach, one of my companions came upon a second nest situated almost exactly as the first one, and also containing three eggs closely similar to those already described. These were also not placed point to point. The specimen taken proved, however, to be considerably more incubated than that first obtained. Judging from these two nests it seems as though the Kentish Plover may be a little later than the Ring Plover in its breeding, as on the previous evening we had found a nest of the latter species, the eggs of which were very much incubated. We also found three young ones, perhaps two or three days old, and in another place a single one about the same age. The flesh-coloured legs of these young birds sufficiently indicated the species.

Some of our party got a good view of the old bird belonging to the second Kentish Plover's nest; but as regards the first, although we retreated to a point out of sight in order to allow the bird to come back to her eggs, yet when we cautiously approached she was off before we got near, and we only obtained quite a distant view of her.

We also came upon several Lesser Terns' nests, mostly with three eggs each: one of these nests contained a very few stems of dry grass, quite an exceptional circumstance; but in most cases the eggs were laid on the bare shingle, without any material whatever.

The measurements of the two Kentish Plovers' eggs were as follows:—

Nest No. 1: Length 1·25 in.; breadth ·9 in.

„ No. 2: „ 1·35 in.; „ ·95 in.

The average measurements of three Ring Plovers' eggs which I also exhibit for comparison are: length 1·38 in.; breadth 1·0 in.

He also exhibited eggs of the Kentish and Ringed Plover.

Mr. J. B. Crosfield presented the following table of dates of the arrival of Migratory Birds in our neighbourhood for 1889, compiled from the observations of seven members of the Club:—

March	28.	Chiffchaff	B. B. G.
„	31.	Wryneck	E. S. S.
April	7.	Wheatear	B. B. G.
„	14.	Willow Wren	„
„	17.	Blackcap	C. E. S.
„	18.	Tree Pipit.....	„
„	19.	Redstart	E. S. S.
„	„	Swallow	A. J. C.
„	20.	Sand Martin.....	J. B. C.
„	22.	Cuckoo	„
„	„	Sedge Warbler.....	„
„	24.	Nightingale	B. B. G.
„	„	Grasshopper Warbler	„
„	„	Martin	„
„	27.	Whitethroat	C. E. S.
„	„	Wood Wren.....	Several.
„	„	Lesser Whitethroat.....	H. C.
May	1.	Corn Crane	J. B. C.
„	3.	Swift	W. F. T.
„	5.	Turtle Dove	„
„	6.	Red-backed Shrike	B. B. G.
„	9.	Spotted Flycatcher	J. B. C.
„	11.	Garden Warbler	„
„	„	Nightjar	Several.

Mr. A. J. Crosfield exhibited specimens of plants collected in Switzerland.

EVENING MEETING.—FEBRUARY 21ST, 1890.

The company of young persons was specially invited.

Mr. Albert J. Crosfield gave an address on the 'BIRDS THAT NEST AROUND REIGATE':—

He considered that out of about 180 species of birds that nest in the British Isles, 91 species may be found breeding in our district. Of these, he regarded 47 species as common; 28 species as more or less scarce; and 16 species as doubtful, but likely to be met with by close observation.

He remarked that gardens and shrubberies are better hunting-grounds for nests than large woods. Some birds again must be sought for on heaths and commons, and others on the banks of rivers or large ponds.

Mr. Crosfield described the nesting-places of a number of the scarcer species of birds that nest in this neighbourhood, including the Long-eared and Tawny Owls, the Grasshopper Warbler, Dartford Warbler, Cir Bunting, Hawfinch, Wry-neck, and several others.

Mr. W. H. Tyndall read a paper on 'HOMES AND HABITS OF SNAKES AND SERPENTS':—

In this paper Mr. Tyndall stated that about 1000 species of Snakes have been recognised, of which about 200 are more or less venomous. In Europe 14 species of Snakes are found, of these the Viper and Asp are the only poisonous ones. After speaking of the anatomy of Snakes, including their poison fangs, the paper described at some length the Rattle Snake, Boa, Bush Master, Cobra, the Death Adder of Australia, and some other species.

Mr. C. E. Salmon presented to the Club a very complete record of the wild flowers found during 1889, showing the numbers observed during each month of the year as follows:—January, 57; February, 32; March, 43; April, 81; May, 196; June, 310; July, 265; August, 201; September, 188; October 121; November, 124; December, 49.

Mr. Alfred B. Gough exhibited a portion of a Mummy of a Cat from Egypt. Some hair of a reddish tinge still adhered to it.

EVENING MEETING.—MARCH 21ST, 1890.

Mr. James B. Crosfield exhibited specimens of *Eucalyptus viminalis* from South Australia, and read a note from Mr. Edwin Ashby, from Adelaide, calling attention to the abundance of flowers on the *Eucalyptus* one year, and the scarcity the following year.

Messrs. E. S. & C. E. Salmon presented the following list of localities for plants found in our neighbourhood during 1889, being supplementary to localities given in Brewer's 'Flora of Reigate':—

Myosurus minimus. In two cornfields near Pendell Court, Nutfield. E. S. Salmon.

Ranunculus Lenormandi. Streams and ditches about the foot of Leith Hill. E. S. Salmon & C. E. Salmon.

Corydalis claviculata. Amongst furze on the top of the hill on Reigate Heath. C. E. Salmon.

Arabis sagittata. Chalky banks at White Hill. E. S. & C. E. Salmon.

Cardamine amara. Round a pond near Pendell Court, Nutfield. E. S. Salmon.

Erysimum cheiranthoides. Banks of Mole at Wonham and Brockham. E. S. & C. E. Salmon.

Diplotaxis muralis. Plentiful at nearly all the railway stations from Gomshall, Horley, Godstone, and Wimbledon to London. E. S. & C. E. Salmon.

Thlaspi arvense. In a field between Merstham and Rockshaw, White Hill. E. S. & C. E. Salmon.

Viola Reichenbachiana. Common about Reigate. E. S. & C. E. Salmon.

Silene armeria. Farrington's Lane, Reigate Hill. (An escape). C. E. Salmon.

Geranium pyrenacium. Railway banks at Purley. By the river at Leatherhead. E. S. Salmon.

Medicago maculata. Near Pendell Court, Nutfield. Plentifully. C. E. & E. S. Salmon.

Melilotus alba. Near Rockshaw, White Hill. Railway banks near Forest Hill Station. C. E. Salmon.

Spiræa Filipendula. Above Chilworth. E. S. Salmon.

Fragaria elatior. White Hill, plentiful. E. S. & C. E. Salmon.

Saxifraga granulata. In Coombe Lane, Croydon.

Chrysosplenium alternifolium. In a copse west of Reigate Heath. C. E. Salmon.

Sedum reflexum. About Burstow. C. E. Salmon.

Drosera intermedia. Shalford Common. E. S. & C. E. Salmon.

Carum segetum. Field in front of the Margery Wood, Reigate Hill; White Hill. C. E. Salmon.

Oenanthe fistulosa. Shalford Common. E. S. & C. E. Salmon.

Galium tricornis. Purley Downs. C. E. Salmon.

Cnicus pratensis. Boggy meadow west of Reigate Heath. E. S. & C. E. Salmon.

Anagallis cærulea. Between Merstham and Rockshaw, White Hill. C. E. Salmon.

Vinca minor. Side of a stream, Wotton, Dorking. C. E. Salmon.

Atropa Belladonna. Headley Lane. E. S. & C. E. Salmon.

Galeopsis speciosa. Field in front of Margery Wood, Reigate Hill. E. S. & C. E. Salmon.

Thesium linophyllum. Purley Downs. C. E. Salmon.

Parietaria officinalis. On a wall in Leatherhead. E. S. Salmon.

Herminium monorchis. Hills above Gomshall. J. B. Crossfield, E. S. & C. E. Salmon.

Allium ursinum. Near Pendell Court. E. S. Salmon. White Hill. E. S. & C. E. Salmon. Burford Bridge. C. E. Salmon.

Mr. B. B. Gough added the following records:—

Ranunculus parviflorus. A single plant on Redhill Common, near the Cottage Hospital, May, 1889.

Senebiera didyma and *Erigeron canadense*. A lane south of Wray Common; also waste ground in the Arboretum, Kew Gardens, July, 1889.

Mercurialis annua. A single plant at Gomshall Station.

Allium ursinum. Banks of a stream at Tinsley, south of Horley.

The Rev. George Wilson, M.A., F.L.S., read a paper entitled 'A BIOGRAPHICAL SKETCH OF JOHN RAY,' in which he described in a graphic and touching manner the career of this father of British Botany.

ANNUAL MEETING.—OCTOBER 17TH, 1890.

The Annual Report and Balance Sheet were read, and adopted as follows :—

HOLMESDALE NATURAL HISTORY CLUB.

Annual Report, 17th of October, 1890.

During the past twelve months 14 members have left the Club through resignation or removal, and one by death; three subscribers have joined the Club; making the present membership 64.

The interest shown in the Evening Meetings was quite equal to that of recent years. The average attendance was twenty-two, not reckoning the meeting in February, when young people were specially invited, on which occasion thirty-seven were present. Owing to the illness of a gentleman who was expected to occupy the evening with a paper, the April meeting was not held. It may be regarded as a sign of life in our Club that the papers and addresses given during the past session were, with one exception, all by our own members. We might specially allude to the lecture on the Arctic Flora given by one honorary member, Mr. N. E. Brown, of Kew, as containing information of more than ordinary value and interest; and to the very able paper by

the Rev. George Wilson, M.A., F.L.S., on 'John Ray,' which for its literary merits, and for the evidences of careful research, far surpassed the standard commonly reached at our meetings. The large number of exhibits also testified to the interest and zeal of our members.

The following are the titles of the papers and addresses for the Session :—

October, 1889. 'The Arctic Flora,' by Mr. N. E. Brown.

November. 'Lunar Rainbow at Reigate,' by Mr. James B. Crosfield. 'Notes from Norfolk, 1889,' by Mr. Charles E. Salmon. 'Report of Excursions, 1889,' by Mr. Bernard B. Gough.

December. 'Notes on Brittany and Jersey,' by Mr. Alfred B. Gough. 'Earthquakes,' by Mr. W. H. Tyndall.

January, 1890. 'Meteorological Notes, 1889,' by Mr. W. H. Tyndall. 'Nesting of the Kentish Plover,' by Mr. James B. Crosfield.

February. 'Birds that Nest around Reigate,' by Mr. Albert J. Crosfield. 'Homes and Habits of Snakes and Serpents,' by Mr. W. H. Tyndall.

March. 'A Biographical Sketch of John Ray,' by the Rev. George Wilson, M.A., F.L.S.

The following EXHIBITS were brought to the meetings of the Club :—A rose of unusual growth, by Dr. Bossey; a *Selaginella*, by Mr. R. Noakes; carpels of *Excæcaria agallocha*, specimens of *Drosera heterophylla*, *D. stolonifera* and *Roridula dentata*, leaves of *Leucodendron argenteum*, by Mr. N. E. Brown; a Salamander, by Mr. A. J. Crosfield; specimens of *Tremellodon gelatinosum*, by Mr. J. B. Crosfield; the skin of a Ring Ousel, by Mr. W. F. Tindall; specimens of plants from Norfolk, by Messrs. E. S. & C. E. Salmon; fossils from Lyme Regis, by Mr. R. Binns; specimen of the Cockspur thorn, by Mr. D. P. Poulter; specimens of plants from Brittany and Jersey, by Messrs. A. B. & B. B. Gough; fasciated specimen of *Orobancha minor*, by Mr. C. E. Salmon; *Toxotus meridianus*, by Mr. C. E. Salmon; specimens of plants from Switzerland, by Mr. A. J. Crosfield; a Snipe, by Mr. W. F. Tindall; eggs of the Kentish and Ringed Plover, by

Mr. J. B. Crosfield; mummy of a Cat from Egypt, by Mr. A. B. Gough; specimens of *Eucalyptus viminalis* sent from South Australia, by Mr. Edwin Ashby.

Messrs. E. S. & C. E. Salmon and B. B. Gough have enriched our archives with records of fresh localities in our neighbourhood for about forty species of plants. Mr. C. E. Salmon has also prepared for the Club a very complete record of the wild flowers found monthly during 1889.

The Club is indebted to its friends for the following presentations:—Twenty bound volumes of 'Science Gossip'; presented by Mr. Richard Noakes. 'Report of the British Association for the Advancement of Science, 1889'; presented by the Association. Botanical Reprints and Reports; presented by Mr. Arthur Bennett, F.L.S. 'Report of the Marlborough College Natural History Society, 1889'; presented by the Society. 'Report of the Nottingham Naturalists' Society, 1889'; presented by the Society. 'Reports of the West Kent Natural History, Microscopical, and Photographic Society, 1888—1890'; presented by the Society.

The Club has published a small volume of Proceedings for the years 1888 and 1889. Copies have been sent to thirty-eight Societies or Clubs engaged in the investigation of natural science.

Several of the outdoor meetings during the past summer were very well attended. As many as thirty-five members and friends availed themselves of the kind permission of W. J. Evelyn, Esq., to visit the grounds of Wotton House, near Dorking, where the party were received by the owner with every possible kindness and attention. The following were the excursions:—

Whole-day Excursions.

- | | |
|-----------|----------------------------------|
| May 10. | Gomshall to Dorking. |
| June 14. | Gomshall to Chilworth. |
| July 12. | Sanderstead and Addington. |
| Aug. 9. | Penshurst Place. |
| Sept. 13. | Wotton House and grounds. |
| Oct. 11. | Ranmore Common and Headley Lane. |

Afternoon Excursions.

- April 26. Outwood.
 May 31. Bury Hill, Dorking.
 June 28. Betchworth Park.
 July 26. Buckland and Reigate Heath.
 Sept. 27. South Kensington Natural History Museum.

THE HOLMESDALE NATURAL HISTORY CLUB.

ABSTRACT OF ACCOUNTS.

<i>Receipts.</i>				<i>Expenses.</i>			
Oct. 17, 1889, to Oct. 16, 1890.				Oct. 25, 1889, to Oct. 16, 1890.			
Balance, Oct. 17, 1889.	11	10	2	Footpath Association.	0	10	0
Sale of 'Flora of Surrey,' &c.	0	12	9	Printing 'Proceedings,' and postage of same.	17	3	5
Members' Subscriptions	17	11	0	Rent, Gas, and Cleaning	16	17	10
Subscribers' ..	6	15	0	Collector's Commission and Stamps.....	1	8	9
				Balance	0	8	11
	<u>£36</u>	<u>8</u>	<u>11</u>		<u>£36</u>	<u>8</u>	<u>11</u>

The following Officers were elected for the ensuing year:—
President, Mr. W. H. Tyndall; *Treasurer*, Mr. J. I. Cudworth;
Secretary, Mr. A. J. Crosfield; *Curator*, Mr. J. Linnell;
Committee, Dr. Bossey, Messrs. T. Cooper, J. B. Crosfield, the
 Rev. J. Menzies, Messrs. J. Bonnor, W. Gilford, R. Binns,
 Ernest S. Salmon, Charles E. Salmon.

Mr. Arthur Bennett, F.L.S., of Croydon, was elected an
 Honorary Member in recognition of many acts of kindness
 done to the Club.

The following were the Exhibits:—Specimens of Bullock-
 head seeds, from Singapore, and two Beetles with brilliant
 green elytra, from Penang, exhibited by Mr. W. F. Tindall;
 snuff-boxes from Kaffir-land made of rhinoceros horn, and of
 the seed-vessels of a species of *Euphorbia*, exhibited by Mr.
 Thos. Cooper. Mr. Cooper stated that the *Euphorbia* made
 use of is highly poisonous, and that the natives soak it well
 in water to cleanse it before use,

Mr. Edward Lovett, of Croydon, described the ART OF MAKING FIRE AMONGST ALL PEOPLES IN ALL TIMES:—

No animal is known to produce fire, whilst no race of men has ever been known to be without fire. It is true that the natives of the Andaman Islands were found to be without the art of making fire, but they had obtained fire from other islanders, and always kept it burning.

Existing traces of prehistoric man are almost always accompanied by charred remains, as in the Swiss Lake Dwellings, and in Kitchen middens.

It is possible that the earliest discovery of a way of producing fire was through seeing forest trees set on fire by friction, through their branches rubbing together in a high wind. Or sparks may have been produced in the manufacture of flints, and have ignited dry grass.

The three modes of producing fire are by *Friction*, *Per-cussion*, and *Compression*.

We find no biblical allusions to the art of making fire, though fire is often spoken of.

In North-east Europe the oldest method of producing fire of which we find traces is by flint and steel. From a cave in Jersey, Mr. Lovett obtained probably the oldest flint and steel in existence. The "steel" in this instance consisted of a nodule of iron-pyrites. It is curious to have in this relic of the flint age an approach to the iron period.

Amongst the ways of producing fire by friction, found in parts of South Africa amongst the Hottentots, and in Australia, is the simple method of rubbing a stick rapidly along a groove. In this method it is best to use a loose-grained soft wood with a hard wood. The Wind River Shoshone Indians use a somewhat similar fire-stick, which they twirl violently round in a hole. The Esquimaux use a fire-drill, which they cause to revolve by means of a thong passed round the upright stick. The Zuni Indians use a bow of walrus ivory to turn the drill. A more elaborate drill, called the pump-drill, is in use amongst the Irriquois Indians, and in the Pacific Islands, and elsewhere. It is notable as being the only savage implement with which civilised men can produce fire.

By *percussion* the chief fire-producer is the flint and steel. Whether this is in use amongst the Fuegians is doubtful. Probably having once obtained fire they have never let it die out. Each Fuegian boat has its slab of stone with fire burning on it. Probably during the Middle Ages in Great Britain the flint and steel were not in use, but fire was carefully stored. Tinder-boxes were certainly not known before the 16th Century. In those days fire would often be borrowed on a pot-sherd exactly as described by Isaiah.

The smugglers' tinder-box was an elaborate weapon with flint-lock which fell upon the steel and sent sparks into the tinder.

By *compression*, fire is produced in Java and Burmah by means of a piston-rod tipped with phosphorus, which when forced into a tube compresses the air, causing heat which ignites the phosphorus.

The modern match depends on three substances for ignition. In the safety-match two of these are upon the match, and the third upon the box.

Mr. Lovett exhibited many interesting specimens of the various apparatuses referred to.

EVENING MEETING.—NOVEMBER 21ST, 1890.

The following Presentations were made :—‘ Proceedings of Croydon Microscopic and Natural History Club, Feb. 1889—Jan. 1890.’ ‘ Annual Report and Transactions of North Staffordshire Field Club and Archæological Society, 1890.’ ‘ Rochester Naturalist, Oct. 1st, 1890 ’; presented by the West Kent Nat. Hist. Soc. Reprint of paper on ‘ Tuberculosis in Fowls,’ by Walter K. Sibley, M.B.; presented by Dr. Holman.

The following records of fresh localities for a number of plants in our district were presented by Messrs. E. S. & C. E. Salmon, supplemented by records made by Mr. B. B. Gough and Mr. W. F. Tindall :—

Caltha palustris. A small form of this plant, which Mr. Beeby says "approaches var. *minor*, Miller." By a stream in the grounds of Wotton House, Dorking. C. E. Salmon.

Papaver somniferum. Very plentiful in cornfields, and by the roadsides, at Coulsdon. C. E. Salmon.

Arabis sagittata. Chalk hills above Chilworth. Farthing Downs, near Coulsdon. E. S. & C. E. Salmon.—Road leading from Dorking Station to Ranmore Common. C. E. Salmon.

Cardamine amara. Near Haxted Mill, Edenbridge; near Crowhurst, near Godstone. E. S. Salmon.

Polygala serpyllacea. On an enclosed heath south of Burstow, near Horley. E. S. Salmon.

Claytonia perfoliata. Pirbright Common, near some cottage gardens. E. S. & C. E. Salmon.

Linum angustifolium. By the Targets, near Caterham. E. S. Salmon.

Geranium pyrenaicum. In the middle of a meadow at Oxted. E. S. Salmon.

Impatiens parviflora. Well naturalized in an old chalk pit above Limpsfield. E. S. Salmon.—On an ivy-covered wall in the Croydon Road, near the Black Bridge, Reigate. C. E. Salmon.

Melilotus alba. Waste ground at Redhill Station. E. S. Salmon.

Melilotus officinalis, Desr. (*arvensis*, W.). By the roadside opposite some brickfields, near Stafford's Wood, near Godstone. E. S. Salmon.—Near the Betchworth Lime Works. E. S. & C. E. Salmon.

Lathyrus Nissolia. Plentiful on the railway banks near Edenbridge, just within the boundary. E. S. Salmon.

Spiræa Filipendula. Buckland Hill. C. E. Salmon.

Potentilla argentea. Footpath leading from Linkfield Lane to Dood's Road; Milton Heath, Dorking. C. E. Salmon.

Sedum album. On an old wall at Merstham. E. S. Salmon.

Drosera intermedia. Fox Hills, near Ash. E. S. & C. E. Salmon.

Enothera odorata. On the railway-bank between Redhill and Reigate. E. S. Salmon.

Apium graveolens. By the roadside, by the Kent Brook, near Edenbridge; very sparingly on the Surrey, and plentiful on the Kent side of this brook, which here forms the boundary of the two counties. E. S. Salmon.—Mr. Beeby says, “The *Apium* I regard as certainly introduced. I do not think it wild anywhere in Surrey now, but it may have been so formerly in marshes by the tidal waters of the Thames.”

Enanthe Phellandrium. In a swamp by the roadside about half a mile from Blindley Heath, towards Horne. E. S. Salmon.

Erigeron Canadense. On a wall in the Croydon Road, Reigate. E. S. & C. E. Salmon.

Cnicus pratensis. Fox Hills, near Ash. E. S. & C. E. Salmon. — Abundant about Hedge Court Mill-pond. E. S. Salmon.

Cnicus arvensis, c. *setosus*, Bess. Near the Betchworth Lime Works. E. S. & C. E. Salmon. (The plant was kindly identified by Mr. N. E. Brown, of Kew.)

Campanula Rapunculus. Plentiful on the railway-bank near Betchworth Station. E. S. & C. E. Salmon.

Hypopythis multiflora. Titsey Woods, near Oxted. E. S. Salmon.

Erythræa pulchella. Reigate and Betchworth Hills. C. E. Salmon.—Buckland Hill. E. S. Salmon.

Gentiana Amarella, b. *præcox*, Raf. Plentiful on chalky ground near Coulsdon Station. E. S. & C. E. Salmon. (The name was confirmed by Mr. N. E. Brown, of Kew.)

Atropa Belladonna. Titsey Woods, near Oxted. E. S. Salmon.

Veronica montana. Abundant between Oxted Station and Limpsfield. E. S. Salmon.

Orchis Morio. On an enclosed heath S. of Burstow, near Horley. Plentiful on the railway-banks between Godstone and Edenbridge. E. S. Salmon.

Iris fetidissima. Titsey Woods, near Oxted. E. S. Salmon.

Convallaria majalis. Crown Prince Woods, near Ash. E. S. & C. E. Salmon.

Setaria viridis. Box Hill, near the water-mill. E. S. & C. E. Salmon.

Scolopendrium vulgare. On a wall in the road leading from Dorking Station to Ranmore Common. E. S. Salmon.

Parietaria officinalis. Pirbright. E. S. & C. E. Salmon.

Paris quadrifolia. Wray Lane, opposite Nutwood, Reigate. C. E. Salmon.

Silene dichotoma. In a field by the side of the railway, about half-way between Chilworth and Shalford. B. B. Gough. (The plant was kindly named by Mr. N. E. Brown, of Kew.)

Anthriscus vulgaris. Reigate Heath, by the Windmill. B. B. Gough.

Phyteuma orbiculare. White Hill. B. B. Gough.

Asplenium Trichomanes. On an old wall opposite Shalford Church. W. F. Tindall.

The Rev. James Menzies read a paper on "THE NATURAL HISTORY OF THE CRAYFISH":—

The following is a short extract from it:—

"Crayfishes do not inhabit every British river, and even where they abound it is not easy to find them at all times of the year. In granite districts, and others in which the soil yields no calcareous matter to the waters which flow over it, Crayfishes do not occur. They are intolerant of great heat, and of much sunshine. They are therefore most active towards the evening, while they shelter themselves under the shade of stones and banks during the day. It has been observed that they have a preference for those parts of the river which run north and south, because of the shade from the mid-day sun.

"During the depth of winter, Crayfishes are rarely to be seen about in a stream, but they may be found on its banks, in natural crevices and burrows which they dig for themselves.

"It does not appear that Crayfishes fall into a state of torpor in the winter. So long at least as the weather is open, the Crayfish lies at the mouth of his burrow, barring the entrance with his great claws, and with his protruding feelers keeps careful watch on the passers by. Larvæ of insects,

water-snails, tadpoles, or frogs which come within reach are suddenly seized and devoured, and it is averred that the water rat even is liable to the same fate."

Mr. J. B. Crosfield read a paper by Dr. R. H. Clarke on "SEPTICÆMIA CANARIENSIS":

In this paper Dr. Clarke described a sudden outbreak of epidemic disease amongst a number of Canaries kept by Mrs. Clarke, from which nearly sixty birds died. It appeared probable that the disease was communicated to the birds by mice.

Dr. Clarke kindly sent for exhibition a number of preparations from the spleens of the diseased Canaries, in some of which bacteria could be seen under a powerful microscope.

Messrs. E. S. and C. E. Salmon exhibited very beautifully mounted specimens of many of the plants named in their list of localities.

EVENING MEETING.—DECEMBER 19TH, 1890.

Mr. E. S. Salmon sent for exhibition a Duke of Burgundy Fritillary butterfly, captured near Godstone.

A paper from Mr. Sydney Webb, "ON HYBERNATING CREATURES AND HYBERNATION," was then read.

Mr. Webb referred to the fact that many animals of different orders pass the winter season in a somnolent or torpid condition, a condition well known, although the laws which govern such condition have only lately been thoroughly understood. He referred to the Rev. Gilbert White, of Selborne, having reluctantly given up the idea that Swallows occasionally hibernated in the country during the winter, and to the fable, once generally believed, that Bears were sustained in winter while in a dormant state by sucking their paws. Mr. Webb stated that the quadrupeds in this country which hibernate in the winter are the Badger, Field Mouse, Vole or Water Rat, the Squirrel, and Dormouse. Bats pass the winter in seclusion; the Hedgehog not

altogether in seclusion, it having been seen searching for food on exceptionally warm days in winter.

The store of provision made by some animals is by many naturalists regarded as provision for a vernal banquet rather than a winter store, provision which can readily be reached on awaking from torpidity. Mr. Webb stated that the hoard, if used at all in the winter, was indulged in but sparingly, as the internal organs were at such time not adapted to large feeding.

Snakes hibernate in company, closely packed together, and in consequence of such habit are often killed in great numbers during their sleeping condition.

Toads creep into crevices; Tortoises hide in the earth, as do Slugs, Woodlice, Earwigs, and Centipedes.

Insects for the most part hibernate solitarily; but the Painted Lady Butterfly, and also the common Blue Bottle, mass together in holes and crevices and dark places, whence they emerge on a warm day. Some insects hibernate as chrysalids; other insects hibernate, insensible to intense cold if it be dry, but suffer from fungus if the cold be damp.

Dr. Hunter, the friend of Dr. Jenner, made experiments in regard to hibernation, and came to the conclusion that while breathing became less, almost to cessation, the heart's action continued, though modified in power; and to supply the place of oxygen to the blood, the fat in the bodies was absorbed by the numerous blood-vessels.

Reference was made to the hibernating of plants and of seeds, which will retain their vitality for years.

Mr. Webb stated that Pheasants after the shooting season continued fat, although supplied with less food, and that Larks were plumpest when the snow was on the ground. Robins, Blackbirds, Thrushes, and Starlings have but little fat, and soon succumb to frost.

Dr. Bossey stated that worms imbedded in grains of corn would retain life for many years, and become active on being released from the grains of corn and placed in water slightly warm,

Mr. C. E. Salmon read a paper entitled "RAMBLES ROUND FOLKESTONE IN JUNE IN PURSUIT OF NATURAL HISTORY":—

Centranthus ruber was seen abundantly on the steep cuttings in the chalk between Orpington and Chelsfield, but doubtfully wild. On the Lees at Folkestone were found *Medicago maculata*, *Carduus tenuiflorus*, and *Vicia bithynica* β . *angustifolia*, the last-named plant being abundant, but chiefly in seed. A few of its beautiful purple flowers were discovered.

On the Lees were also found *Apium graveolens*, *Samolus Valerandi*, *Lepidium Draba*, *Sedum album*, *Mercurialis annua*, and *Iris foetidissima*, the latter having the smell of roast beef, and by its scent attracting flies, which have been known to lay eggs on the plant.

Along the undercliff which extends from Folkestone to Dover, *Hippophae rhamnoides* (Sea Buckthorn) was found. *Linum angustifolium* and *Ranunculus trichophyllus* were met with, as well as *Lithospermum officinale*, *Parietaria diffusa*, and *Rubia peregrina*; the last named was in great abundance. Viper's Bugloss with pure white blossoms was also seen, and thousands of spikes of the normal colour.

The Nottingham Catch-fly (*Silene nutans*) was found on ascending the cliff. This plant is interesting on account of the faded condition of its petals during the daytime, but they expand as evening approaches. *Silene nutans* has a fine scent from about 8 o'clock in the evening until about 3 o'clock in the morning, and by its scent attracts many winged insects which feed on the honey at the base of the petals, and thus cross-fertilize the plant. The insects visiting the flower are chiefly those which fly in the evening and at night.

Lathyrus Nissolia was fairly plentiful, and near Dover *Diplo-taxis tenuifolia* was one of the most conspicuous and abundant of the cliff plants.

On the grassy level at the foot of the cliffs where the Channel Tunnel operations are being carried on, *Rubia peregrina* was again found in abundance, and *Orobanche amethystea* more sparingly; all the specimens we came across were apparently parasitical on *Anthyllis vulneraria*. *O. Caryophyllacea* was in fair quantity, but the plant was in seed.

Visiting Hythe, search was made in vain for *Malva borealis*, but at a later period in the year it was found at Kingsdown, near Deal; it has also been found near Edenbridge.

At Cæsar's Camp several species of Orchis were found, and among others *Ophrys Arachnites* (the late Spider Orchis).

Among the moths and butterflies seen were Large and Small Skippers, Small Blues, and Cinnabar Moths, handsome insects in crimson and green. A fine larva of the Oak Eggar Moth was found.

Mr. Salmon exhibited a number of pressed plants, very well prepared.

EVENING MEETING.—JANUARY 16TH, 1891.

Mr. J. Linnell exhibited a Hornet's nest from America,

Mr. E. S. Salmon exhibited a specimen of Cock's-foot grass (*Dactylis glomerata*) in a viviparous condition.

Mr. A. W. Ingram exhibited a Long-tailed Tit's nest which had been built in a bramble about 5 ft. from the ground. He stated that, even with some of the pieces of bramble that were attached, the weight did not exceed an ounce.

Mr. B. B. Gough reported the following ornithological observations:—Two Pochards seen on the New Pond, Earlswood Common, March 28, 1889. Five Whimbrel flying over Walton Heath, May 14, 1890, probably on their way to northern breeding quarters. A small party of Hooded Crows in Tilgate Forest, near Balcombe Tunnel, Nov. 10, 1890. A Water Rail seen by a frozen pond near Bletchingley, Dec. 11, 1890. Four Wild Geese seen flying over near Chaldon, Dec. 15, 1890; and a flock of 18 flying over Gatton, Dec. 30, 1890. He also mentioned that last summer a pair of Barn Owls had their nest in one of the old elm trees in Gatton Park, near the church; the young remained in the nest as late as Aug. 10.

Mr. J. B. Crosfield stated that Mr. A. Lister reported that during the recent very severe weather, among the birds which came to feed on the crumbs which he had put out for

them at Lyme Regis was a female Blackcap. Some days later he picked up this bird dead. He also stated that flocks of Bramblings and Tree Sparrows had been plentiful there during the prolonged frost; and that specimens of the White-fronted Goose had been picked up dead, and shot in the same neighbourhood. Mr. J. B. Crosfield mentioned that while crossing London Bridge on the 8th inst. he saw several Larks flying over.

Mr. W. H. Tyndall then read a paper entitled "METEOROLOGICAL NOTES, REDHILL, FOR 1890":—

BAROMETER.—The extreme variation of the year was 1·79 in., the maximum reaching 30·62 in. on the 23rd of February, and the minimum 28·83 in. on the 23rd of January. There was a rapid rise of nearly an inch from the 23rd of January to the 24th, from 28·83 in. to 29·77 in. On the 5th and 6th a strong wind prevailed from the S.W., with rain, but the barometer, instead of falling, as is usual with a strong westerly wind with rain, rose from 29·79 in. on the 5th to 30·24 in. on the 6th, and to 30·40 in. on the 7th. The extreme variation of the month was 1·57 in. On 17 days the barometer reached 30 in. and upwards; on 13 days 29 in. and under 30 in.; and on 1 day under 29 in. as above, and this was the only day during the year on which it did not reach 29 in. and upwards. The mean of the month was 29·95 in. In February the range was 1·11 in. from 30·62 in. to 29·51 in. 23 days it was as high as 30 in.; 5 days it fell below 30 in. In this month the mean height was great, 30·18 in., the same as in September. In March the barometer ranged low, being only 12 days above 30 in., and 19 days under. In April also the order was preserved, being 9 days only up to 30 in., and 21 days below. This condition continued in May, the relation being 10 days above 30 in.; 21 days below. In June the order was reversed, and there were 20 days 30 in. and upwards, and 10 days below 30 in. July saw a nearly equal division, being 15 days above 30 in.; 16 days under. August showed no improvement, being 14 days above 30 in., and 17 below; but in September and October, especially in September, a con-

siderable rise took place, there being 23 days of September and 21 days of October over 30 in., and 7 days of September and 10 days of October under 30 in. In November there was again a fall, but a considerable rise in December. During the year the barometer rose to 30 in. and upwards 195 times; to 29 in. and under 30 in. 169 times; and once under 29 in. On the 19th of December the barometer fell $\cdot 65$ in., rising again $\cdot 58$ in. on the following day. A rapid fall occurred from the 6th to the 7th of November, amounting to $\cdot 64$ in.

THERMOMETER.—January varied considerably in its average temperature from the usual mean, the average of the month being $42\cdot 68^{\circ}$, instead of 36° . On 13 days the temperature rose above 50° , and on 7 days only at night it fell below freezing-point. The wind blew from the S.W. or W. during the whole of the month, and occasionally strongly from that quarter, and these S.W. gales in winter almost invariably bring a high temperature. For the most part the wind rises towards the evening, and continues until about sunrise the next morning, when the force is lessened, until the evening, when it is again liable to rise. The maximum temperature of the month was 53° on the 6th, the minimum day temperature 33° on the 1st, and the minimum night temperature $25\cdot 50^{\circ}$ on the 2nd. On the 5th the minimum temperature of the 24 hours was $47\cdot 5^{\circ}$; and on the 7th, 11th, and 26th, it never fell below 46° .

February was cold, the average temperature of the month being only $36\cdot 25^{\circ}$; the maximum being 50° on the 18th, the minimum 24° on the 28th; the temperature was below freezing on 15 nights. Although the average temperature was under the mean of several years, the weather was fine and open, more bright sunshine being recorded than is usual for the month, and this was especially so in the Midland and Eastern Counties.

March was remarkable for an excessively cold night on the 3rd and morning of the 4th, the thermometer falling to $8\cdot 50^{\circ}$ in the Oxford Road, and in other positions in the neighbourhood a few degrees lower. The thermometer fell below freezing on 13 nights, and on the 2nd it did

not at any time of the day rise above 31.50° . At Greenwich the thermometer fell to 31.1° in the daytime. There had not been so low a day temperature in March since 1845, when it fell also to 31.1° on the 27th in that year. The mean of the minimum temperature for 50 years at Greenwich was 24.7° . The low temperatures in England on the 3rd and 4th were chiefly in the Eastern and South Midland and Southern Counties. In the Eastern, a small district near the Wash, in Norfolk, the temperature fell to 6° . In a small district near Chelmsford it fell to 7° , and in a district in Surrey and Kent cut in two by the meridian of Greenwich it fell to 5° , 6° , and 9° , being 5.4° at Beddington, 6° at Kenley, 7.8° at Beckenham, 8.5° at Addiscombe, and 9° at Reigate and Brockham. In the extreme N. of England and the extreme S.W., the temperature, though low, was not excessive, being from 20° to 24° in Cornwall, and 24° to 27° in Northumberland. The thermometer fell below the freezing-point on 13 nights. There were on the 26th and 27th warm nights, in which the thermometer did not fall below 46° , but the maximum day temperature was not very high, 54° and 58.5° . The average of the month was 41.44° .

No very marked variations of temperature were experienced in April. The mean temperature was rather below the average. On 6 nights the glass fell below freezing.

May was a remarkably genial month, well redeeming its character for beauty. Everything seemed to combine to give it charm. The foliage of the trees unfolded rapidly, unbroken by winds, and not damaged by insects. There were no frosty nights to cut off the blossoms or young fruit. The thermometer never fell below 37° . The highest night temperature was 53° , and the highest day temperature 74.50° . It reached 70° and upwards on 3 days. The average of the month was very nearly the average of the last 50 years. The mean maximum of the day was 64.16° . Probably no more agreeable temperature can be enjoyed than between 60° and 70° of Fahrenheit.

June was also a fine month, somewhat warmer than May, having an average temperature of 59.88° . The thermometer

reached 70° on 12 days; the maximum was 77.50° on the 25th. It never fell below 41.50° .

July was not so genial, being cooler than the average. The temperature reached 70° and upwards on 15 days, the maximum being 77° on the 23rd, the minimum being 43° on the 11th.

August also was cool, though the temperature reached 70° and upwards on 11 days, the maximum being 78° on the 5th, the minimum 36° on the 31st.

September ranged nearly 3° above the average, the highest temperature of the year, 79° , occurring on the 5th. There were no frosty nights in September, the minimum temperature being 44° on the 1st and 12th.

October on the average was cool. On 5 nights the temperature fell below freezing, the lowest temperature at 4 ft. from the ground in the shade with a northern aspect being 23.50° on the 27th; the maximum temperature was 66° on the 4th, being 12.5° less than the maximum of September. The low temperature on the 4th was lower than had been observed at Greenwich during the month of October for a period of 50 years.

November was cool. On 9 days the glass fell below 32° , and on 4 days it did not rise above the freezing-point, a very unusual occurrence for November. The maximum was 58° on the 23rd, the minimum 9.50° on the 28th. This low temperature for November was as unusual as the low temperature in March. The difference between the maximum and minimum was 48.5° , showing a very considerable range for November. One cause of the low temperature on the 28th was a clear sky at night, with snow on the ground. It was the coldest night on record in Nov., at least for the last 50 years.

December was very cold, the average temperature being only 28.64° , about 10° below the average for 50 years. The maximum temperature was 43° on the 4th, the minimum 11° on the 11th. The thermometer fell below freezing on 27 days, and did not rise above freezing-point during 12 days. Usually there are not more than 4 or 5 days in the year on which the temperature does not at some part of the day rise above

freezing, but during 1890 there have been 16 days on which 32° was not reached. On 82 days it fell below freezing; on 52 days it rose to 70° and upwards, but never reached 80°. This of course refers to the observations at Oxford Road, Redhill. In other parts of the country there have been lower and higher temperatures. On the whole, while May and June were genial, July and August were ungenial; September and October were fine.

RAIN.—Rain to the extent of .01 in. and upwards fell on 172 days, the total fall in the year being 28·14 in.

January was a wet month, consequent on the prevalence of W. and S.W. winds bringing much moisture from the warmer regions of the Atlantic. Rain fell on 24 days, but the maximum within any 24 hours was $\frac{1}{2}$ in. only. There were 13 days continuously, from the 21st of January to the 2nd of February, on which rain fell.

February has acquired the name of “Fill ditch.” In the year 1890, however, it scarcely deserved that name, nor do I know that it does ordinarily deserve it. In last February less than an inch of rain fell on 11 days only. It is true there were only 28 days in the month, but the proportion of rain notwithstanding was very much less than in January and March. Two periods of six days’ continuance each were experienced without any rain, from the 6th to the 12th, and from the 21st to the 26th.

March, which usually is one of the driest months in the year, was in 1890 a wet month, the total fall being nearly 3 in. The number of days on which rain fell was not great, namely, 14, but there was a continuous heavy fall of 1·13 in. on the 19th and 20th. Notwithstanding the excess of rain, there were two periods of 7 and 11 days continuously on which no rain fell, *viz.*, from the 11th to the 17th, and from the 26th to the 5th of April; but there were 8 days of continuous rain from the 18th to the 25th.

In April the total fall was 2·39 in. on 15 days. It rained each day from the 21st to the 26th, but no rain fell from the 27th to the 3rd of May. A heavy fall of 1·04 in. occurred on the 25th.

In May the fall was light, as might be expected in that month, being 1·62 in., occurring on 10 days, with a maximum fall of ·52 in. on the 9th. No rain fell from the 20th to the 29th.

In June 3·50 in. fell (on 17 days), with a maximum fall of ·97 in. on the 12th.

July was a wet and inclement month for the season; two heavy falls occurred, 1·55 on the 4th and 5th, rain being continuous, and ·89 on the 17th, the total of the month being 4·49 in. on 17 days. It rained each day from the 7th to the 13th.

August was also wet; 2·94 in. fell on 16 days, with a maximum fall of ·72 in. on the 19th.

September was fine; only 1·16 in. fell on 8 days; for 14 days, from the 3rd to the 16th, no rain fell, but it rained each day from the 17th to the 23rd.

October, which usually is the wettest month in the year as regards the quantity of rain, was a comparatively dry month last year. Rain fell on 11 days to the extent of 1·33 in. No rain fell from the 8th to the 14th, nor was there any excessive fall during the month.

In November rain fell on 22 days to the extent of 2·43 in., pretty evenly spread throughout the month.

December was remarkable in many ways. The excessive cold has been referred to. It was remarkable also for dryness. Only ·71 in. of rain fell during the whole month. Rain fell on 7 days only, or rather snow fell equivalent to ·71 in. of rain. No snow or rain fell from the 4th to the 14th, and again from the 21st to the 29th. Rain or snow fell on fewer days than in any other month of the year, September approaching next, when it rained on 8 days only.

The total amount for the year was about an average for this district, where more rain falls than in London or at Greenwich. Here the high range of chalk hills attracts the clouds which come charged with moisture from the South and South-west. The colder region of the upland country condenses the vapour, and causes it to fall in rain, which is discharged before it reaches Greenwich or London.

During December northerly and north-easterly winds prevailed, which as a rule are dry winds, and, if not dry, they often discharge their vapours on the lands of the N.E. counties before they reach the southern lands of Surrey.

WIND.—A strong wind from the S.W. prevailed on the 5th and 6th of January, which was remarkable only as being in connection with a rising barometer. Heavy gales were experienced from the S.W. from the 21st to the 29th of January, with much damage at sea. With these gales the barometer fell, recording on the 23rd the lowest reached during the year, 28·83 in. A heavy gale from the N.W. prevailed on the 4th, with the heaviest fall of rain observed during the year, namely, 1·55 in. There was also a gale at night on the 6th of November, with nearly $\frac{1}{2}$ in. of rain.

SNOW fell on the 27th and 28th of February, and on the 1st and 2nd of March. Again on the 26th October, and from the 25th to the 29th of November; on the last day to a small extent only. Again slightly on the 7th of December, but not to measure ·01 in.; and on the 15th to 20th, and on the 30th and 31st; but in no case has there been a heavy fall in this district, nor much drift; although in some parts of England the fall has been great, and the drift has occasioned much inconvenience in road travelling.

THUNDER.—Redhill and its neighbourhood are not usually visited by heavy thunderstorms. On the 11th and 12th of June thunder was heard; on the 12th it was accompanied by heavy rain, when in one shower nearly an inch of rain fell; this was about 10 in the forenoon. Thunder was heard about noon on the 7th May, without rain. Thunder was again heard in the afternoon of the 17th of July, about 2 o'clock, again accompanied by heavy rain, amounting to ·89 in. In August, on the 10th, in the morning, some thunder was heard, and rain fell to the extent of nearly $\frac{1}{4}$ in. The storm of the 17th of July was more severe to the westward of Redhill. Near Betchworth Station a tree was struck, a large arm torn off, and the tree apparently destroyed.

About 4 p.m. on Wednesday, the 29th January, prismatic rays were seen about 30° from the sun, in the west. Below the prismatic rays were dense clouds.

Fogs prevailed largely in November and December. In London they were very dense and dark.

Having regard to the average fall of rain at Redhill for the last 24 years, from 1867 to 1890, the following is the result:—

Average fall in each Month. IN.		Average fall in the Year. IN.	Average No. of Days when Rain fell.
Jan.	2·97 (3)	30·70	177
Feb.	2·23 (8)		
Mar.	2·01 (11)	The greatest fall in any one year was in 1886—34·51 in.	
Apr.	2·09 (10)		
May	1·97 (12)		
June	2·15 (9)	The least fall in 1884—23·03 in.	
July	2·68 (6)		
Aug.	2·47 (7)		
Sept.	2·95 (4)	The greatest No. of days of rain was in 1872—215 days.	
Oct.	3·30 (1)		
Nov.	3·08 (2)		
Dec.	2·81 (5)	The least No. of days was in 1870—130 days.	

Mr. B. B. Gough read a "REPORT OF EXCURSIONS FOR 1890":—

April 26th.—A large party met at Nutfield Station, and proceeded across the fields towards Outwood Common. Signs of an early season were everywhere apparent, the Oaks being in leaf, and spikes of the Early Purple Orchis were gathered. Nightingales and Cuckoos were heard on Outwood Common. At "Copseley," the members were kindly entertained with tea by Mrs. Alexander.

May 31st.—A half-day excursion took place to the grounds of Bury Hill, Dorking, with the special object of seeing the Rhododendrons, which were then in their prime. The edge of a large pond in front of the house was strewn with remarkably large empty shells of the Swan Mussel (*Anodonta cygnæa*), some of them measuring fully half a foot in length.

June 14th.—Three members took an early train to Dorking, and ascended the hill to Ranmore Common, gathering on the

METEOROLOGY.—OXFORD ROAD, REDHILL, SURREY (1890).

Month.	BAROMETER.				THERMOMETER.							RAIN.	
	Max.	Date.	Min.	Date.	Max.	Date.	Min.	Date.	Average.		Mean.	Total of No. of days Month. .01 fell.	
									Max.	Min.			
Jan. .	30.40	7	28.83	23	53.0	6	25.5	2	47.66	37.69	42.68	INCHES. 3.66	24
Feb. .	30.62	23	29.51	15	50.0	18	24.0	28	41.45	31.05	36.25	0.92	11
March	30.44	3	29.29	25	60.5	28	8.5	3	49.39	33.50	41.44	2.99	14
April .	30.36	1	29.27	25	65.0	30	28.5	12	53.20	37.38	45.29	2.39	15
May .	30.33	22	29.48	11	74.5	24	37.0	2	64.16	43.11	53.64	1.62	10
June .	30.41	15	29.50	30	77.5	25	41.5	7	68.85	49.92	59.38	3.50	17
July .	30.26	20	29.32	1	77.0	23	43.0	11	68.89	52.23	60.56	4.49	17
Aug. .	30.28	5	29.49	27	78.0	5	36.0	31	68.21	50.55	59.38	2.94	16
Sept. .	30.49	7 & 27	29.70	20	79.0	5	44.0	1 & 12	68.41	50.07	59.24	1.16	8
Oct. .	30.50	22 & 23	29.50	26	66.5	4	23.5	27	55.95	39.71	47.83	1.33	11
Nov. .	30.52	20	29.20	7	58.0	23	9.5	28	48.16	36.16	42.17	2.43	22
Dec. .	30.30	22 & 27	29.22	19	43.0	4	11.0	11	33.94	23.34	28.64	0.71	7
Year.	30.62		28.83		79.0		8.5				48.04	28.14	172

way some fine spikes of the Large White Helleborine (*Cephalanthera pallens*). The notes of the Cirl Bunting were heard, and one was observed for some time uttering its short song very frequently. A young brood of Golderests were noticed, busy among the boughs of a Spruce Fir. On Ranmore Common the songs of the Willow Wren and Whitethroat were heard every few minutes. These two species seemed to predominate over the other Warblers in numbers. For some time the party paused to listen to the soft sweet song of the Garden Warbler. This little bird is capable of uttering inexpressibly soft notes, followed by a burst of melody. Its song much resembles that of the Blackcap. From Ranmore Common a westerly course was pursued along the top of the hills between Dorking and Gomshall. The Foxgloves were in their prime. Several newly-emerged specimens of the Pearl-bordered Fritillary flitted past. The long-continued trill of the Grasshopper Warbler was listened to. The rest of the party were joined at the Silent Pool. The Silent Pool is remarkably clear and deep, and many large Trout were disporting themselves in it. The road leading to the top of the chalk-hills was then followed past Newlands Corner to the hill on which St. Martha's Chapel stands. A Nightjar on being put up was seen to clap its wings smartly over its back. *Sedum acre*, *Potentilla argentea*, *Teesdalia nudicaulis*, and *Corydalis claviculata* were found near the chapel. The steep path down the hill through woods to Chilworth was then followed. By a pond near the station, *Impatiens fulva* was noticed growing. Fifty-three species of birds were seen or heard during the day.

June 28th.—From Boxhill Station a small party walked to Betchworth Park, noted for its fine old Spanish Chestnuts. The path was then followed to Brockham Green, and thence to Betchworth Station. On the way a fine Stag Beetle was caught.

July 12th.—Two members took the train to Warlingham, and thence walked in the direction of Woldingham. About half-past eleven a halo was seen round the sun, and towards the north side another larger one, the circumference of which

crossed the sun. The walk was continued along the ridge of the chalk range until the old-fashioned village of Oxted was overlooked, when a descent was made past some large lime-works to the station.

July 26th.—A party of five met at Betchworth Station, and walked thence by way of Buckland Green to Reigate Heath. *Potentilla argentea* and *Sedum Telephium* were found in a sandy lane which led to Reigate Heath. In a wet corner of Reigate Heath grew Sundew (*Drosera rotundifolia*) amongst the Sphagnum Moss, also Marsh Penny-wort (*Hydrocotyle vulgare*), and Lesser Skull-cap (*Scutellaria minor*). *Veronica scutellata* and *Radiola Millegrana* grew in wet sandy parts; and *Helosciadium inundatum* in shallow pools. The Adder's-tongue Fern (*Ophioglossum vulgatum*) was met with, growing in one patch only.

August 10th.—Four members met at Penshurst Station, and proceeded along the road towards the Park. The Park is well wooded, and contains many magnificent trees, one of which, Sir Philip Sidney's Oak, was estimated to be 13 ft. in diameter, or nearly 40 ft. in circumference. A Spanish Chestnut that was also measured was found to be over 20 ft. in circumference. *Sparganium neglectum* was found in fruit not far from the station. Stock Doves were breeding in the Park.

On September 13th an excursion was made to Wotton House and grounds by kind invitation of W. J. Evelyn, Esq. The day proving fine, thirty-five members and their friends were present. Near Abinger Hammer the var. *puberula* of *Saponaria officinalis* was growing freely by the roadside. Arrived at the picturesque Manor House of Wotton, the party was hospitably received, and shown the varied and valuable collections contained in the library, including several portraits of King Charles the First and the prayer-book used by him on the scaffold, portraits of John Evelyn, and the original MSS. of his Diary. Most of the afternoon was spent very pleasantly in the magnificent grounds, which abound in fine timber, and through which flows a brook, on which a pair of elegant, black Australian Swans were swimming and

constantly uttering their peculiar, soft cry. In the wooded parts of the grounds *Gnaphalium sylvaticum* was observed. The party was conducted through the gardens of Wotton House by Mr. Evelyn, who informed them that a large part of the gardens remains nearly as it was designed by the celebrated John Evelyn, and that one fountain has been flowing for 200 years. A very curious specimen of the tame Duck was pointed out, in which the web was entirely absent from the feet. In the stream close to the house *Mimulus luteus* was in great abundance, it being well established both in this brook and in the one that flows through the Rookery at Westcott.

October 11th. — The morning opened with frost and white mist. On Ranmore Common, Honeysuckle still lingered in flower. Redwings were heard and seen among the Hawthorn-bushes, and the ripe Yew-berries attracted large numbers of Missel and Song Thrushes. After spending some time in search of Fungi, which were not plentiful, the valley that comes out into the road to Burford Bridge, past the ruined chapel, was followed. *Polyporus squamosus* was found growing on a stump by the roadside, and two or three species of *Hygrophorus*. Crossing the Mole, the party reached the main road near the village of Mickleham, and turned up Headley Lane. About a mile up the lane, a footpath led across undulating ground (on which was an abundance of Houndstongue, *Cynoglossum officinale*, in seed) to Betchworth Clump, and thence down the hill to the station.

Mr. J. B. Crosfield further stated, in reference to the excursion on the 14th June, that on that occasion some of the members who were out the whole day through, in order to gain some idea of the relative numbers of the various species of Warblers, carefully noted the number of each species heard during the day, with the following result:—

Willow Wren . . .	36	Wood Wren . . .	7
Whitethroat . . .	18	Nightingale . . .	4
Chiffchaff . . .	9	Garden Warbler . .	3
Blackcap . . .	8	Grasshopper Warbler	1

The Nightingales were none of them singing, but only uttering their piping and croaking alarm-notes, so that the comparison may perhaps hardly give a fair idea as regards that species.

Mr. E. S. Salmon read a paper entitled "A SUMMER HOLIDAY IN CORNWALL AND THE SCILLY ISLES":—

In this paper Mr. Salmon detailed the results of his observations during a little over a fortnight spent in Cornwall and the Scilly Isles in the latter part of July, 1890. Amongst the plants found in the Scilly Isles were *Lotus hispidus*, *Alyssum maritimum* (naturalized on several walls at High Town), *Smyrniun Olusatrum*, *Erodium moschatum*, *E. maritimum*, *Hyoscyamus niger*, *Osmunda regalis*, *Euphorbia Paralias*, *E. Portlandica*, *Bartsia viscosa*, *Ornithopus ebracteatus*, *Ophioglossum vulgatum* var. *polyphyllum*, *Lavatera sylvestris*, *Scrophularia Scorodonia*, *Asplenium lanceolatum*, *A. marinum*, and *Reseda alba*. On Guther's Island there was an abundance of the Tree Mallow; the whole island appeared to be overrun with rats; Oystercatchers, Curlews, Cormorants, and Shags were seen.

Annet Island is crowded with birds; vast numbers of Gulls (Greater and Lesser Black-backed and Herring) incessantly screaming; a stream of Puffins to and from their burrows, carrying fish to their young; Common and Lesser Terns wheeling and screaming close to us; literally hundreds and hundreds of young Gulls, some crouching in hollows, and some running and tumbling down to the sea, their parents wheeling close to our heads, screaming angrily all the while; the whistling of parties of Oystercatchers, and the constant twittering of the Rock Pipits,—all these produced a scene which will be long remembered. We dug out many burrows of the Manx Shearwater, which in a great many places completely undermined the island, and fortunately found two addled eggs and several young birds in the down. It was too late for the eggs of Gulls or Puffins; but an adult Puffin was caught and photographed, but rather unsuccessfully; they are so strong that it is hard to hold them. Although late in the season,

we found over six nests of the Common Tern, and also, after a long hunt, two eggs of the Oystercatcher, and a young bird of this species. The young Gulls, when handled much, disgorged a quantity of half-digested fish.

Rosevear, a small island to the south of Annet, is the breeding haunt of the Stormy Petrel, but, much to our regret, we were unable to visit it, as a landing can be effected only in calm weather, and then with some difficulty.

In the neighbourhood of Penzance the scarce grass, *Fibichia umbellata*, was found, and near it *Melilotus parviflorus* and *Centaurea solstitialis*. Near Helston, Mr. Salmon and his brother gathered the Autumnal Squill (*Scilla autumnalis*), *Anchusa sempervirens*, *Briza minor*, and *Verbascum virgatum*. In Penrose Woods, which slope up from the shores of Looe Pool, they first saw the plant so characteristic of Cornwall, the Cornish Heath (*Erica vagans*). *Mimulus luteus* was well established in marshy places at the head of the lake, and near the same spot they found one of the rarest plants, *Lythrum hyssopifolia*. In another part of the lake *Elatine hexandra* grew plentifully. *Briza minor* and *Bartsia viscosa* were in abundance near it.

On rocks near Gunwalloe Church *Herniaria glabra* var. *subciliata* grew in bright green patches, and a Sea Lavender (*Statice auriculæfolia*, a. *occidentalis*) was found sparingly. On the cliffs between Helston and the Lizard *Erythræa capitata* var. *sphærocephala* was met with. This plant is very scarce, having been recorded only from Sussex, the Isle of Wight, Cornwall, Guernsey, and Sweden.

The plants found in the Lizard district included *Scilla autumnalis* (which covered the turf in places), *Sanguisorba officinalis*, *Cyperus longus*, *Vicia lutea*, *Serratula tinctoria* var. *monticola*, *Herniaria glabra* var. *subciliata*, *Thalictrum minus*, *Salvia clandestina*, *Inula Helenium*, *Alisma ranunculoides*, *Pinguicula lusitanica*, *Geranium striatum*, *Trifolium Molinerii*, *T. strictum*, *Geranium sanguineum*, *Asparagus officinalis* var. *prostratus*, and *Allium sibiricum*.

Mr. Salmon's last day in Cornwall was spent in the neighbourhood of Lostwithiel, where *Lobelia urens* was seen in such

abundance as to give a bluish tinge to the field in one place by its lovely flowers. Two other scarce plants were found in the same neighbourhood, *Hypericum undulatum* and *Sibthorpia europæa*.

The paper was illustrated by a large number of specimens of the plants referred to, and by a large series of photographs. Mr. Salmon also exhibited eggs of the Manx Shearwater and Oystercatcher which he found in the Scilly Isles.

EVENING MEETING.—FEBRUARY 21st, 1891.

Young people were specially invited to attend.

Mr. Henry M. Wallis, of Reading, gave an address on 'A NATURAL HISTORY TOUR IN NORWAY.'

Mr. Wallis described the birds met with on the coast, in the forest region, and on the bare fells.

On a small island not far from Christiansund, he met with Curlew, Redshank, White-tailed Eagle, Eider Duck, Great Black-backed Gull, Common Gull, about a hundred pairs of Common and Arctic Terns, Skuas, a pair of Turnstones, whose deserted nest he found covered with a tuft of grass, and Sheldrake which had nine young.

Near the head of the fiord he watched an Osprey plunge into the water in pursuit of fish. Mr. Wallis called attention to the toes of the Osprey, which move on a freer basis than those of the Eagle.

On the lower slopes the Pied Flycatcher is an abundant bird. It often nests in boxes put up for the purpose in gardens, or against the telegraph poles, and at the railway stations.

In the forest region, amongst the Scotch firs and birches, Woodcock, Redstart, Chaffinch, Brambling, Northern Bullfinch, Fieldfare, Song Thrush, Redwing, Mealy Redpole, and Merlin, were met with. The Brambling, unlike its congener the Chaffinch, often lays eight eggs. The Fieldfares commonly nest in colonies; you may meet with two hundred

nests, each containing five to seven eggs, within a short distance; the birds are very clamorous, and will drive off Magpies, or even small Falcons. The Redwing usually nests on a bank or on the ground under a bush, but sometimes at a height of twenty-five feet from the ground in a fir tree. The Merlin often uses the old nest of a Crow; at other times it lays on the ground. The Kestrel is not common on the Dovrefield.

The abundant rivers are frequented by the Dipper, and the Grey-headed and White Wagtails. The Dippers which occur in Norway differ from our Dippers in having the under parts black instead of chestnut. The black-bellied race also occurs in Ireland.

On the fells above the forest region a very dwarf flora is found, consisting of Willowscrub, dwarf *Azalea procumbens*, and a small Rhododendron, which also grows in Spitzbergen. In this region the Snow Bunting was nesting. The Blue-throated Warbler takes the place of the Robin, which it resembles in manner and song. It nests amongst grass-tussocks and reeds. Amongst other fell-birds are the Golden Plover, the Dotterell (which lays only three eggs), the Scaup Duck, Long-tailed Duck, Rough-legged Buzzard, Jer Falcon, Ptarmigan, and Smew. The Blue Hare and Lemming are the chief quadrupeds of the region.

Mr. Wallis exhibited a fine series of skins illustrative of his address.

EVENING MEETING.—MARCH 20TH, 1891.

The following presentations were made:—‘Transactions and Journal of Proceedings of the Dumfriesshire and Gallo-way Natural History and Antiquarian Society, 1887—1890’; ‘The Rochester Naturalist’ for January, 1891; ‘The Field Club’ for January; ‘Report and Proceedings of the Belfast Natural History and Philosophical Society, 1889—1890’; ‘Report of Alford Naturalists’ Society.’

Mr. C. E. Salmon exhibited specimens of the following

beetles :—*Pelobius Hermannii* (from a pond in Ashdown Forest), *Niptus hololeucus* (from office in Dowgate Hill).

Mr. W. H. Blaber, F.L.S., F.E.S., of Groombridge, read a paper on 'BRITISH LEPIDOPTERA; THEIR METAMORPHOSES, STRUCTURE, AND HABITS, WITH HINTS FOR COLLECTORS':—

Mr. Blaber stated that the total number of different kinds of insects known to inhabit England alone is about 12,000. This seems a large number, but insects are by no means so abundant in England as in the adjacent parts of the Continent, nor are they so destructive to our crops. The cutting down of forests, and draining of fens and marshes has led to the destruction of a large number of insects, and those that are indigenous to such spots run a great risk of becoming exterminated. Take for instance the Large Copper Butterfly (*Lycana dispar*), which, though once common in the fens of Cambridge and Huntingdon, has now quite disappeared owing to the draining of the fens. In Scotland and Ireland insects are not nearly so abundant as in England. Nearly every insect we possess in this country is to be met with on the Continent, and in many cases in much greater abundance than with us. There are, however, a few species which have failed to establish themselves across the Channel.

Mr. Blaber advocated a careful study of butterflies' eggs, remarking that each species has its own peculiar kind of egg, with distinctive features in shape, colour, structure, or markings. Some are globular, others are pear-shaped, barrel-shaped, or bowl-shaped, while others again are exquisitely fluted, ribbed, or covered with a kind of net-work of raised lines. Some indeed have a lid at the top, and Mr. Blaber has often watched a young caterpillar lift this off on hatching from the egg, and making his first appearance. Eggs, as a rule, are continually changing colour, and, as the time arrives for them to hatch, generally become darker, owing to the gradual development of the tiny caterpillar inside, and by aid of the microscope we can, in some eggs, observe its jaws at work eating a way out. The substance of the egg-shell is peculiar, being apparently like thin horn, and

is very elastic, pliable, and tough. Hunting for the eggs of Lepidoptera is without doubt a most difficult matter, but collectors should in spite of this do all they can in this direction, for apart from the fact that eggs exist in infinitely greater numbers than either larvæ or pupæ, we are more than rewarded for our trouble in searching by being afforded an opportunity of rearing the species from the egg, and thus gaining a practical insight into the economy of its earlier stages. Whenever eggs are found we should carefully avoid touching them, and they should be placed in a cool spot, and not allowed to become too dry, otherwise they will shrivel up and come to nothing.

The length of time taken by the eggs of Lepidoptera to hatch varies much according to the temperature and time of year; those laid in summer hatch generally in a few weeks, whilst others deposited in the autumn remain over until the following spring. When the time for hatching has at last arrived, the caterpillar inside bores away at the shell, and then enlarges the hole by means of its jaws until it can creep out. Many kinds before turning to their proper food make a hearty meal off the shell from which they have just escaped.

After describing the structure of caterpillars, Mr. Blaber referred to their enemy, the Ichneumon Fly. He stated that he once counted over three hundred grubs of the Ichneumon Fly emerge from the skin of a larva of the Common Tiger Moth.

He said that the larva of the Goat Moth had been known to eat its way through a piece of sheet-lead by enlarging the holes that had been made for ventilation.

Referring to the pupæ, he said that in warm summer months butterflies have been known to emerge from the pupa in seven or ten days only, but most Lepidoptera require a much longer time. There are certain species which naturally now and again do not develop the moth for two, three, or even five years. One of the most remarkable instances of this long life in the pupa state is afforded by the Small Eggar Moth (*Eriogaster lanestris*), which frequently fails to emerge for the first two seasons or so. It has often

been proved that by means of artificial frigidity the development of a chrysalis may be retarded for many years beyond its proper time, just as heat would seem to exercise exactly the opposite effect.

After describing the emergence of the butterfly from the pupa, Mr. Blaber said:—"If we examine an insect immediately it has left the pupa, we find that we are able to draw out its wings to their normal size, so easily do they stretch, thereby proving that all the proportions are as well-formed as they ever will be, and only require expansion. Frequently the insect during emergence ruptures one of its little veins, the fluid therefrom escapes, and the result is a cripple with crumpled wings. Generally within an hour the development is complete, and the wings are ready for flight.

"The emergence of moths from their cocoons is more difficult. Some species, such as the Puss Moth (*Dicranura vinula*), are provided with an acid secretion which they discharge, and by its solvent power the wall of the cocoon soon loses its cohesion, and gives way to the slightest pressure. With some other species the means of egress is provided for by the caterpillar, by leaving a small portion at one end to act as a hinge. A much more elaborate contrivance is, however, resorted to in the case of the flask-shaped cocoon of the Emperor Moth (*Saturnia pavonia*). It is generally of a solid tissue of layers of silk, almost of the texture of parchment, but at the narrow end it is composed of a series of loosely-attached threads converging, like so many bristles, to a blunt point, in the middle of which is a circular opening. It is through this opening that the moth emerges. The aperture is a sort of reversed funnel formed of converging threads that readily yield to pressure from within."

Mr. Blaber described the organs of the perfect insect, and mentioned that in Great Britain we can only muster sixty-six different species of butterfly, whilst the moths number nearly 1900 species. Some of these are very local as to their habitats, being very common in one particular spot, and extremely rare elsewhere.

In conclusion, Mr. Blaber urged his hearers to a diligent study of the life-history of the insects they met with.

In illustration, Mr. Blaber exhibited specimens of pupæ, perfect insects, drawings of insects' eggs, &c.

EVENING MEETING.—APRIL 17TH, 1891.

Mr. E. S. Salmon exhibited specimens of *Helleborus viridis* found by him at Four Elms, near Edenbridge.

Mr. Sydney Webb exhibited a most remarkable collection of specimens of the Currant Moth and Small Tortoiseshell, showing a great deal of variation.

'The Report of Marlborough College Natural History Society' for 1890 was presented by the Society.

Mr. Gilford read a paper entitled 'ARE THERE COALFIELDS IN SURREY?'—

It may assist us, if, in entering upon this subject, we consider in the first instance the various formations from those of this district to those down to the Coal-measures with their thicknesses, if all were found in their position and typical thickness. We have first the Chalk formation, the Upper Greensand, the Gault, the Lower Greensand, the Weald Clays, and the Hastings Sands; all these formations forming the Cretaceous system of an aggregate thickness of 2600 feet, and consisting of all the formations spread out before us from the standpoint of the Chalk of the North Downs, to the Chalk of the South Downs in the dim distance.

The next series of formations commencing with the Purbecks, the Portland Rocks, the Kimmeridge Clays, the Oxford Clays, and the Oolites, the last of which comprise the Ironstone district of Northamptonshire. The whole of these formations belong to the Oolitic system, 2200 feet thick.

The next are the Liassic formations, consisting of the upper, the middle, or Marlstone, and the lower Lias, altogether 1200 feet thick. These formations are found covering the greater part of Leicestershire.

The next are the New Red Sandstones, in three divisions of alternate sands and marls, 1500 feet thick. The town of Leicester lies on this formation. This is the lowest in the series of secondary rocks.

The next formation is the newest and uppermost of what are called the Old or Primary Rocks, and is called the Permian system, a series of Magnesian Limestones, 800 feet thick. Underneath this lies the Carboniferous formation, in which alone, in England at all events, the true Coal-measures are found. The distance from the top of the Chalk to the Carboniferous formation is therefore 8,300 feet if all these formations were found in their place, and of their full thickness. Some have, however, never been deposited in this part, or, if deposited, have been swept away.

In May, 1855, Mr. Godwin Austen read a paper before the Geological Society, in which, from a careful study of the geological phenomena of Belgium, and the West of England, he inferred that the axis of the Ardennes in Belgium was the same as our Mendip Hills, and that these two out-cropping parts of a long line of elevation of old rocks were connected by an underground ridge of the same hidden by the mass of overlying and unconformable secondary rocks; he states that the depression of the Thames Valley represents, and is physically a continuation of, that which, extending from Valenciennes, by Donai, Bethune, Theroanne, and thence to Calais, includes the great Coal trough of these countries, and he infers that at an early time a line of disturbed surface was produced, having a general E. and W. direction, and which, traversing a portion of the area of Coal growths, has placed all the members of that series along its course either at or near its present surface, and that we have strong reasons for supposing that a band of Coal-measures coincides with, and may some day be reached along, the valley of the Thames; while some of the deeper-seated Coal, as well as certain overlying and limited basins, may occur along and beneath some of the longitudinal folds of the Wealden denudation. (This hypothesis brings in the whole breadth of Mid-Surrey in this locality within its sweep.) This theory was afterwards con-

firmed by a boring at Harwich, in which a black slaty rock of the Carboniferous period was found immediately below the Gault. A sinking also at Kentish Town is further proof; the Lower Greensands, and also all the Oolitic series, being absent. And Mr. Prestwich acknowledges the evidence that there is under the central part, at all events, of the London Tertiary area a tract or ridge of old rocks immediately underlying the Chalk or Gault, on different portions of which the wells of London and Harwich have touched; the one on the Old Red Sandstone, and the other on the Carboniferous formation; and that these old rocks at London and at Harwich both belong to the rocks of the Mendips and the Ardennes. In 1877 more light was thrown on the question by a boring at Meux's Brewery, in Tottenham Court Road, where rocks older than the Coal-measures were found immediately under the Secondary Rocks, at a depth of 1100 feet. In 1860, Sir N. N. Smith, after a short description of the Coal-measures under Cretaceous beds in the North of France, said:—"A comparison of these features with those exhibited on the flanks of the Mendip Hills, and an observation of the underground course of the sharp trough of French Coal strata, inclines us to the speculation that the Primary Rocks may be continuous from the Severn to the Rhine." In 1871, Professor Prestwich writes, "Should the Coal-measures again set in to the westward of Calais (that is, in England) they would be found equal in productiveness to the great Coal-fields of the North of France and Belgium." That they do so set in is now clearly shown by their discovery at Dover. He also says, "Everywhere along the old tract of Carboniferous and Devonian Rocks, from Westphalia to South Wales, there appears to have been an old growth of Coal-producing vegetation of great luxuriance and persistence; everywhere along the immediate flanks of the great axis traversing that old tract we find rich and productive measures, however much they may deteriorate as they recede from that line, and there is no reason to believe but that we should find the same productiveness along the flanks of the same underground ridge, although at a distance of 20 or 30 miles from it a

falling-off might possibly be found; on these grounds we believe that the Coal-measures, should they exist under the Secondary Rocks of the South of England, will be found in full force, and in full productiveness." Professor Prestwich also observes, "In the case of the anticlinal axis taking a southern course, we should look for the Coal along a line passing from Radstock, through the Vale of Pewsey, and thence along the North Downs to Folkestone."

In 1878, Monsieur Dewalque said "that it was most probable that the dip of these Upper Devonian beds at Meux's was to the south, and that they belong to the extension of the Belgium Northern basin." "The Coal formation may therefore recur at a short distance south of London, and at a workable depth." In 1880, Professor Hull said, "We must look to the tracts lying south of the Thames Valley as the possible areas of concealed Coalfields." In 1882, Professor Judd stated that the evidence obtained from these borings at Meux's, &c., proves that the rocks forming the old palæozoic ridge are bent into a series of east and west folds, and among these folds it is highly probable that Coal strata will be found, probably long and narrow basins like those of Belgium and Northern France, having the longer axis directed from east and west. In the same year, Mr. Firket concluded that the westerly underground extension of the Franco-Belgian Coal-basin is South of London.

From our present knowledge we have a right to infer generally that while older beds rise up in succession northward from the neighbourhood of London, southward, on the other hand, the Jurassic beds are likely to thicken, and therefore that the surface of the older rocks will sink in that direction. Professor Whitaker, who has given special attention to the subject, and whose opinion carries great authority, writes:—"One of our greatest Coalfields is in the south, that, namely, of South Wales. Eastward of this, and continuing along the line of great disturbance that has resulted in bringing the older rocks within touch under London, is the Bristol Coalfield. Much farther east again, and still along the same line, are the Coalfields of Belgium

and of the North of France; what evidence we have therefore seems to lead us to two conclusions, *i. e.*, that Coal-measures are likely to occur somewhere along the line of the Thames Valley, or in neighbouring tracts, and that these Coal-measures are likely to yield workable Coal. It is rash to attempt to foretell the future, but it seems to me that the day will come when Coal will be worked in the South-east of England."

Nearly all the leading geologists are now of opinion that the line of Coal-measures will be found along the North Downs, and that they will be found in detached fields from five to eight miles in width somewhere a few miles south of London, it being found that underneath London rocks older than the Coal-measures are found immediately under the Secondary Rocks, the Coal-measures being missing; while on the other hand, the lower Secondary Rocks have a tendency to thicken south of the North Downs, as in the boring at Netherfield, where they began in the lowest beds of the Wealden formation, and ended 2000 feet in depth in the Oxford Clay. I may say that I have offered a site for boring on the North Downs, about two miles east of Caterham. Professor Whitaker appears to think that a likely spot, but suggests that a site a few hundred yards more to the north, on the same estate, would be better, as the Secondary Rocks would be thinner, and the Coal, if found, would probably be nearer to the surface.

As to the condition of the Coal-measures when found, Professor Prestwich writes:—"The division of the Coal-measures into separate basins appears to be their normal condition along the great line of disturbance between the French Coalfields and those in Somersetshire and South Wales. The transverse ridges separating the different basins are subordinate to the great east and west axis, and are never wide nor long-maintained. The length of those portions of the axis between West Pembroke and Frome, and between Calais and Dortmund, is 472 miles, and in this distance there are eight separate Coalfields of an aggregate length of 350 miles, leaving only 122 miles occupied by intervening tracts of older

rocks, or only about one-fourth of the entire space, and we see no reason why, from what we trace above ground of the axis of disturbance, the same proportion of continuity should not obtain in the intervening space."

The great east and west axis of disturbance took place after the deposition of the Coal-measures, and before that of the Permians. Its effects all through its range are singularly alike. It is not so much a great mountain elevation as a crumpling up and contortion of the strata for a breadth of many miles, varying from 30 to 80 miles, and along a length of above 800 miles.

The similarity of the conditions under which Coal is found in Somerset and South Wales, and in Northern France and Belgium, and the similarity of the Coal itself, and the remarkable way in which the deductions of our geologists have been confirmed as to the continuity of the ridge or elevated plain of old rocks through all the intermediate distance by the borings in and near London, and also the recent discovery of Coal at Dover, a point at which Mr. Godwin Austen and Prof. Prestwich, and other leading geologists all placed their line of probable Coalfields on its first entering England from Northern France; all these corroborations give great weight to their views as to the more central parts of the line of probable Coalfields laid down by them along the flanks of the elevated axis of disturbed old rocks now discovered to exist underneath London in accordance with their deductions, and their line of probable Coalfields passes in Surrey rather north of the escarpment of the North Downs than south of it, and somewhere underneath the Chalk district of Surrey between here and Croydon; and, I believe, the question at the head of this paper will receive an answer in the affirmative in the discoveries of the future.

In the discussion which followed, Mr. Webb pointed out the great cost of starting a fresh Coal-pit. He questioned if workable Coal could be found in any part of Surrey, except South London; he thought it might also be obtained in North Kent. He did not believe that Coal of good quality had as yet been found in the Dover workings.

Mr. Albert J. Crosfield read a paper on 'MID-WINTER IN CORSICA':—

In this paper I propose briefly to report the results of observations made on the natural history of Corsica during a stay of three weeks at Ajaccio in December, 1889, and January, 1890.

The time was the most unfavourable of all the year for finding plants in bloom. The autumn flowers were over, and the spring flowers were not yet out. The number of species that actually blossom in mid-winter is very small. The most noticeable of these was the Arbutus (*A. Unedo*), which is an abundant shrub on the hillsides and more sheltered valleys. Its red and orange berries and ivory blossoms hang at the same time upon the bush. Its dark, glossy, green foliage gives colour to the slopes, where it is commonly surrounded by other bushes in yet greater profusion, amongst which are the white and rose-coloured Cistuses (*Cistus salvifolius* and *C. albidus*); the Mastic or Lentisk (*Pistacia lentiscus*), from which gum-mastic is obtained; Rosemary (*Rosmarinus officinalis*); the Myrtle (*Myrtus communis*); and the purple-bracted Lavender (*Lavandula Stachas*, L.). Trailing over these shrubs, one often notices the shiny leaves of the Smilax (*S. aspera*, L.); its wiry stems, well armed with sharp spines, are by no means to be despised when you wish to force your way through a thicket; it is closely akin to the South American Sarsaparilla. Another trailing plant is the graceful *Asparagus acutifolius*. Butcher's Broom (*Ruscus aculeatus*) is also abundant.

Near the sea-shore we met with a stiff, fleshy shrub belonging to the Daphne tribe, *Thymelæa hirsuta*, Endl., with small, terminal flowers, yellow within, and silky without. Amongst the rocks were great tufts of a Sea-Lavender (*Statice*), one of the imbricate species, but I could not identify it from the dried-up flower corymbs.

Another bush (*Stachys spinosa*), bristly by reason of its stiffly pointed branches, bears a fragrant, yellow, labiate flower. At Ajaccio I found no blossoms on it, but I met with a few of its flowers at Boconagno, some twenty miles inland, and about 2500 feet above sea-level.

Of smaller plants, I met with about twenty in all in flower. At Boconagno the large Hellebore (*Helleborus lividus*) formed fine tufts. There I also gathered the Corsican Heath (*Erica corsica*).

In the Olive gardens about Ajaccio the curious little brown Capuchin Arum (*Arisarum vulgare*, Targ., Tozz.) was in bloom. The ground in such places was carpeted with seedling Lupines, Clovers, Peas, and Vetches; whilst Grape, Hyacinths, and sundry Orchids showed their sprouting leaves above the soil.

In an Orange garden I found, as a weed, a large-flowered Wood-sorrel (*Oxalis Lybica*), with clear-yellow petals. The Cottage Marigold (*Calendula arvensis*, L.) was a common plant. I noticed also *Lamium purpureum*, *Trifolium pratense*, *Euphorbia peplus*, *Ranunculus repens*, and *Veronica cymbalaria*, Bod. The place of our common Daisy was taken by the larger species *Bellis sylvestris*.

Two weeds which have spread far and wide I noticed in Corsica, namely, *Solanum nigrum* and *Erigeron canadense*. The former is, I believe, found almost all over the world; the latter, having got a footing in Europe, appears to be largely on the increase.

On some of the shady banks, growing in rich leaf-mould, I found *Cyclamen hederæfolium* in profusion. One or two of its blossoms still lingered, but most were over. On the shore of the gulf I gathered the Horn Poppy (*Glaucium luteum*). *Alyssum maritimum* (Candytuft) was abundant. So was a composite plant with hoary foliage (*Conyza ambigua*). The violet-coloured Bugloss (*Echium plantagineum*) grew more sparingly.

Thousands of Asphodels were springing up on the banks and hillsides and everywhere. Where land was being broken up for the first time by the plough, I found the tuberous roots of these Asphodels in bunches as large as a man's skull. From the tall dry stems that still adhered to some of these roots I take the species to be *Asphodelus ramosus*.

If the season was unfavourable for flowers it was peculiarly good for birds. I had moreover the great advantage of the

company of my cousin, Mr. James Backhouse, author of the 'Handbook of European Birds,' to whom I am indebted for the loan of the skins that are on the table. Between us we identified seventy species of birds in Corsica, either living or in the market. I know not that I have ever been at a place where birds were more abundant.

First and foremost I must place the Blackbird. Snow-bound Europe must have sent vast flocks of Merles to this isle of the Mediterranean, where they fattened on the Myrtle-berries on every hillside. These flocks of Blackbirds are no mean addition to the food supply of Corsica. Day after day baskets-full might be seen in the markets, mingled with a sprinkling of Thrushes, Missel Thrushes, and Redwings, with here and there the Blue Rock or Solitary Thrush. On your country rambles you met *Chasseurs* in pursuit of "*gibier*," alias Blackbirds, with gun or snares. Under such treatment even Blackbirds become very wary birds.

Amongst Warblers by far the most abundant was the Blackcap. From the olives on any sunny day you might hear his low warble; not the full song, but a more subdued version of it which we have often heard on their first arrival in this country in the last days of March, or in early April. Another Warbler common around Ajaccio, but unknown to us in England, is the Sardinian. I was not long in catching sight of a little bird with the manners of a Whitethroat, but with slaty back, jet-black crown, white breast, and red eye-brows. This was the cock Sardinian Warbler. The hen is scarcely distinguishable from the Lesser Whitethroat.

The Stonechat, Robin, and Chiffchaff were common birds. The Chiffchaff was silent; its plumage was noticeable for the bright yellow at the base of the wings. It was only after careful examination and measurement of the bird that we were sure of the species.

In the marshes around the head of the gulf Cetti's Warbler was in considerable quantity. It is a shy, retiring bird. We heard its "chit" again and again, but it would seldom show itself, and then only to take a short flight, and dive again into the rushes or undergrowth.

One Dartford Warbler I met with on the hillside, and a few Black Redstarts near the shore. Firecrests were rather common in the fir trees. Hedge Sparrow we met with here and there.

Of the Tits, Blue and Great were plentiful; Coal I saw at Boconagno. The Long-tailed proved to belong to the race discovered by Col. Irby in the Pyrenees, and known as *Acredula irbii*. This is a very interesting record, as this particular race has only been known from the South of France, Spain, Northern Italy, and Sicily. Irby's Long-tailed Tit differs from the British race in having the scapulars grey instead of vinous, whilst both differ from the usual Continental type in having much less white upon the head.

The Creeper we met with amongst the Spanish Chestnut groves at Boconagno. The Wren was in the marshes. Of Wagtails the White and the Grey were fairly common. The latter were most difficult to shoot, but finally Mr. Backhouse examined a specimen from the market. The Meadow Pipit was to be seen following the plough. I got a near view through my glass of an Alpine or Water Pipit on the roadside amongst the snow at Vizzavona, about 3000 feet above the sea.

The Swallow tribe was represented by the Crag Martin, a bird which nests in Switzerland, and under the rocky ledges of cliffs in the Alpes-Maritimes.

Goldfinches were often to be seen in small flocks near the shore. A flock of about forty Citril Finches were feeding in some Alders at Boconagno. We met with smaller flocks near Ajaccio. On one occasion we met with a flock of about thirty Serin Finches on waste land near the gulf. Greenfinch and Linnet also occurred on the waste lands. Hawfinches were frequently seen in the market; they probably came from the woods inland. The Sparrows were all Italian Sparrows. Chaffinches were, without exception, the commonest birds. They rose in hundreds from the hillsides below the Olives. Many birds we noted were in specially bright plumage; cock Chaffinches had exceptionally broad and pure white bars on the wings, bright greenish yellow on the rump, dark rose-colour on the breast, and pearly white bills.

The common Bunting of Corsica is the Cirl. A cock and two hens usually went about in company.

Skylarks were scarce; Woodlarks rather common. The Woodlark's call-note is softer than that of the Skylark, and their shorter tail and wings are noticeable in flight.

The Starling we did not see alive, but met with one in the market. The Jay also we found in the market. Hooded Crows were abundant; I counted twenty-four in one ploughed field. Raven and Carrion Crow were seen flying over.

The Greater Spotted Woodpecker I saw in a pine wood at Vizzavona. Wrynecks were often for sale in the market, but we saw no living ones. A single Kingfisher we put up in the marshes at the head of the gulf.

Amongst birds of prey we repeatedly saw Buzzards, and proved the species to be the Common Buzzard from a dead one picked up on the beach. The Common Kite and Kestrel were both seen several times, and Mr. Backhouse saw an Osprey on a rock in the gulf.

Cormorants, Razorbills, and Manx Shearwaters frequented the sea. Mr. Backhouse also got a sight of a Merganser.

Wild Ducks were plentiful in the marshes, which also abounded with Snipe. Teal, Wigeon, Waterhen, Land-rail, Water-rail, Jack Snipe, and Woodcock were in the market, which also produced Wood Pigeon, Rock Dove, Quail, French Partridge, and Peewit. The Water-rails were of a distinctly larger type than our British birds.

Several species of Gull frequented the harbour. The only ones we certainly identified were the Black-headed.

Tufted Ducks and Coots were met with in the market at Bastia.

Mr. Crosfield exhibited a number of pressed specimens of plants mentioned in his paper; also skins of the rarer species of birds, lent by Mr. Backhouse. He also exhibited a nest of the Trap-door Spider from Corsica.

ANNUAL MEETING.—OCTOBER 16TH, 1891.

The 'ANNUAL REPORT AND BALANCE SHEET' were read and adopted:—

HOLMESDALE NATURAL HISTORY CLUB.

Annual Report, Oct. 16th, 1891.

During the past twelve months five members and five subscribers have joined the Club. Two members have been lost through death; five have resigned, or left the neighbourhood, leaving the present membership sixty-seven.

The range of subjects treated of during the winter session was more varied than in some previous seasons, as will be seen by reference to the table of subjects given below. The attendance at the ordinary Evening Meetings averaged twenty; about sixty persons were present at the February meeting to which young people were specially invited, when Mr. H. M. Wallis, of Reading, graphically described some of the birds and flowers seen by him during a summer visit to Norway.

The following are the titles of the addresses:—

Oct. 17th, 1890. 'The Art of making Fire amongst all peoples in all times,' by Mr. Edward Lovett.

Nov. 21st. 'The Natural History of the Crayfish,' by the Rev. James Menzies. 'Septicæmia Canariensis,' by Mr. R. H. Clarke, M.A., M.B., M.R.C.S.

Dec. 19th. 'On Hibernating Creatures and Hibernation,' by Mr. Sydney Webb. 'Rambles round Folkestone in pursuit of Natural History,' by Mr. Charles E. Salmon.

Jan. 16th, 1891. 'Meteorological Notes for 1890,' by Mr. W. H. Tyndall. 'Report of Excursions, 1890,' by Mr. Bernard B. Gough. 'A Summer Holiday in Cornwall and the Scilly Isles,' by Mr. Ernest S. Salmon.

Feb. 20th. 'A Natural History Tour in Norway,' by Mr. H. M. Wallis.

March 20th. 'British Lepidoptera, their Metamorphoses, Structure, and Habits, with hints for Collectors,' by Mr. W. H. Blaber.

April 17th. 'Is there Coal in Surrey?' by Mr. W. Gilford.
'Mid-winter in Corsica,' by Mr. A. J. Crosfield.

The interest of the Evening Meetings was greatly enhanced by the exhibition of the following specimens:—Fungus from house at Nutfield; bullock-head seeds from Singapore; beetles from Penang; rhinoceros-horn snuff-boxes; seed-vessels of a species of *Euphorbia*; various apparatuses used for the production of fire; preparations from the spleens of diseased Canaries; specimens illustrating new local records of plants; Duke of Burgundy Fritillary Butterfly caught near Godstone; specimens of plants from the neighbourhood of Folkestone; hornet's nest from America; viviparous specimen of *Dactylis glomerata*; nest of Long-tailed Tit; skin of Little Grebe; fasciated bough of Ash; plants from Cornwall; photographs of eggs in the nest, &c.; eggs of Manx Shearwater and Oystercatcher from the Scilly Islands; skins of birds from Norway; *Niptus hololeucus* from London; various insects and pupæ and drawings of insects' eggs, &c.; *Helleborus viridis* from near Edenbridge; a fine series of specimens of the Cur-rant Moth and the Small Tortoiseshell Butterfly; plants and skins from Corsica.

Some additional localities for some of our rarer plants have been reported to the Club by E. S. & C. E. Salmon, B. B. Gough, and W. F. Tindall; and some interesting ornithological observations were reported by B. B. Gough and J. B. Crosfield.

The museum library has been enriched by the following donations:—'Proceedings of the Croydon Microscopic and Nat. Hist. Club, Feb. 1889—Jan. 1890,' also Feb. 1890—Jan. 1891; presented by the Club. 'Rochester Naturalist,' Oct. 1st, 1890, also for Jan. 1891; presented by the West Kent Nat. Hist. Soc. Reprint of paper on "Tuberculosis in Fowls," by Walter K. Sibley, M.B.; presented by Dr. Holman. 'Transactions and Journal of Proceedings of the Dumfriesshire and Galloway Natural History and Anti-

quarian Society, 1887—1890'; presented by the Society. 'The Field Club' for January. 'Report and Proceedings of the Belfast Nat. Hist. & Philosophical Soc., 1889—1890'; presented by the Society. 'Report of Alford Naturalists' Society'; presented by the Society. 'Report and Transactions of Penzance Nat. Hist. and Antiquarian Society, 1890—1891'; presented by the Society. 'Report of Marlborough College Nat. Hist. Society for 1890'; presented by the Society. 'Report of the British Association for the Advancement of Science, for 1890'; presented by the Association. 'Handbook for Cardiff and district'; presented by the Hon. Local Secretaries of the Brit. Assoc. Meeting.

Some of the excursions during the summer months have been well participated in by good numbers of members and their friends. On the occasion of the visit to Ashdown Forest, those who took part in the excursion were very kindly entertained during the afternoon by our honorary member, W. J. Evelyn, Esq., at Northwood House, near West Hoathly. The following excursions were made:—

Whole-day Excursions.

- May 9. Fox Hills, Pirbright Common, & Mitchet Lake.
- June 13. Oxted and Hills.
- July 11. Copthorne Common and Hedgecourt Millponds.
- Sept. 12. Forest Row, Brambletye House, & West Hoathly.
- Oct. 10. Bookham and Leatherhead.

Afternoon Excursions.

- April 25. Deepdene.
- May 30. Farthing Down, Chaldon, and Alderstead Heath.
- June 27. Gomshall, Albury Heath, and Chilworth.
- July 25. Coulsdon, Chipstead, and Merstham.
- Aug. 22. Buckland Hills.
- Sept. 26. Betchworth, Rice Bridge, and Reigate Heath.

species of Fig, and it was possible that the mode of fertilisation differed in different species. The Figs which we eat are not the ovary, but the receptacle; the small seeds in the Fig are the fruit, each one being the result of a perfect flower. The fertilisation is dependent on the Fig insect, or *Euphristes*, which acts in measure like a gall.

Messrs. E. S. & C. E. Salmon exhibited beautiful specimens of the following plants:—*Ranunculus tripartitus*, *Eranthis hyemalis*, *Chara vulgaris* var. *longibracteata*, *Agrimonia odorata*, all from Surrey; *Spiranthes aestivalis*, from the New Forest; *Malva pusilla*, from Edenbridge; *Fritillaria Meleagris*, from Pinner; *Anemone pulsatilla*, from Tring; *Helleborus foetidus*, from Clayton, Sussex; *H. viridis*, from Four Elms, Edenbridge; *Astragalus glycyphyllos*, from near Loddington, Kent; *Rhynchospora alba*, from the New Forest.

EVENING MEETING.—NOVEMBER 20TH, 1891.

The 'Report and Transactions of the Cardiff Naturalist's Society for 1890' was presented by the Society.

Dr. Bossey exhibited some fine specimens of *Plumatella*, from the New Pond, on Earlswood Common.

A fine series of pressed plants from North Wales was exhibited by Messrs. E. S. & C. E. Salmon; also a specimen of the rare beetle, *Chrysomela cerealis*; and some photographs of birds' eggs in the nest, &c.

Mr. Tyndall stated that the rainfall for October, as measured by him at Redhill, amounted to 7·24 inches. This amount has but once been exceeded in twenty-two years at Redhill during October. The average fall for the month is a little over 3 inches.

Mr. E. S. Salmon read a paper entitled 'THREE WEEKS' HOLIDAY IN NORTH WALES IN PURSUIT OF NATURAL HISTORY':—

To a botanist who is acquainted only with the Flora of the lowland counties, the first visit to a mountainous country must always be an eventful one, for at and above an elevation

of 1000 ft. a Flora of a great many new plants commences, and, in addition to these, which are common to mountains, there are the true alpine or arctic plants,—relics of an old Flora,—of which there are over 200 British species. It was therefore with the expectation of having a rich botanical time that we set out in June last for a visit to the neighbourhood of Snowdon and the island of Anglesea, N. Wales.

On the evening of our arrival at Bangor we called on Mr. J. E. Griffiths, who possesses an unrivalled knowledge of Welsh botany, and to whom Mr. Arthur Bennett had very kindly given us an introduction. He advised us to visit Holy Island, off Anglesea, as soon as possible, to be in time for the flowering of two very rare plants, *Senecio spathulæfolius*, and a Rock-rose (*Helianthemum Breweri*). On our way to the coast from Holyhead station we noticed *Fumaria confusa*, plentiful as a weed in cultivated ground, and *Ranunculus heterophyllus*, a Water Crowfoot, covering a pond with its white flowers.

On arriving at the sea-cliffs we found, covering their face, an abundance of Portland Spurge, while the turf above was largely composed of *Scilla verna*, the bright blue Vernal Squill. We kept to the coast, which is extremely rugged, for some miles, coming across a few plants of a hybrid Violet, *V. intermedia*, H. C. Wats., until, in a grandly picturesque cove, we first saw the *Senecio*, just in the prime of flowering. It is a strange fact that although the seed of this plant, adapted by its pappus for wind-carriage, must be often borne inland, it has never been found here away from the sea, and this is all the more curious since its only other British station, Mickel Fell, Yorkshire, is many miles from the coast. The *Senecio* occurred at several places on the cliffs between this cove and the South Stack Lighthouse, together with large patches of the beautiful *Geranium sanguineum*, and Golden Samphire. Near the South Stack Lighthouse grew the lovely Rock-rose (*Helianthemum Breweri*), a small plant with five bright yellow petals, each with a deep red spot at its base. The flowers last but one day, falling soon after noon, or directly on being touched, and the peduncle then gradually falls down, and forms a right angle with that of the flower that opens next.

Littorella lacustris (Shore-weed) covered the margin of a pond near; and among the short turf around, the curious little dwarfed var. *capitata* of the Common Centaury grew.

Around Llanberis we had our first glimpse of the beautiful mountain Flora. *Saxifraga stellaris* grew abundantly in moist places, even by the road-side; Globe-flowers, Water Avenas, and Butterwort by almost every lake and stream; and the curious *Lobelia Dortmanna*, not yet in flower, but with its buds well pushed up above the water, grew in the waters of most of the lakes. In a wooded dell the sides of many rocks were covered with the delicate fronds of the Filmy Ferns, *Hymenophyllum Wilsoni* and *tunbridgensis*. A Hawkweed, *H. orarium*, was also gathered, and *Mimulus luteus* was established in several large patches; and not far away grew *Symphytum tuberosum*. *Ranunculus Lenormandi* occurred in several places near Llanberis, and we met with this species about Beddgelert, and in Anglesea also.

In the neighbourhood of Twll Dú, a terrific chasm 450 ft. long, 100 ft. deep, and only 6 ft. wide, a crowd of new plants grew. *Sedum Rhodiola* hung from the rocks in masses, with bright green tufts of *Oxyria digyna*; a few purple flowers of *Saxifraga oppositifolia*, trailing over the rocks, were still out, and *Silene acaulis* formed bright pink, rounded cushions, the flowers so close together as to hide the leaves. We could scarcely stop to look at these, however, for we knew that *Lloydia alpina* (the Mountain Tulip), the rarest of the rare Welsh plants, grew near. Climbing down to the very brink of the precipice, and looking carefully around, we saw perhaps nearly thirty plants of *Lloydia*, but for the most part absolutely unapproachable. However, by careful climbing, for the rock was wet and slippery, and a false step might have been fatal, three plants of *Lloydia* were at last reached.

In Cwm Glas Bach we first came across the Alpine Meadow Rue (*Thalictrum alpinum*), and by the streams there were the most beautiful soft cushions, covered with large white flowers, of the Moss Saxifrage (*Saxifraga hypnoides*); and in many places the small delicate flowers of *Alsine verna* appeared, almost hidden in the short grass. As we ascended the valley

we found the beautiful *Asplenium viride* growing sparingly on the rocks; and a Buzzard was seen several times, soaring high, and only occasionally settling on some mountain peak.

On a ledge in the rocks overhanging the upper lake of Llanberis some Red-throated Divers stood motionless, while several were seen constantly diving, and only showing their heads and long necks in the water. Not far from the lakes the rare and curious *Elisma nutans* grew, with its tuft of quill-like leaves rooting in the mud, and sending up delicate slender stalks, which bear small and shining oval leaves; these long thread-like stalks, which by curling and twisting always keep the leaves and flowers floating on the surface of the water, seem specially adapted for the often rapid rise and fall of mountain lakes. In the same place we found the little Awlwort (*Subularia aquatica*), which flowers and fruits under water; and almost everywhere by the shores of the lakes themselves there were dark green tufts of Quillwort (*Isoetes lacustris*).

From the summit of Snowdon another day we went a little way along a ridge of mountains, the Crib Goch spur, and then, by sliding and scrambling, managed to get to the bottom of Cwm Glas. In one of the lakes there the Awlwort was plentiful, and in wet places around grew *Selago Selaginoides*, with trailing patches of *Salix herbacea*. On one of the steep sides of the Cwm *Saxifraga nivalis* grew among masses of other lovely mountain Saxifrages.

Most of our last day in these parts was spent by the stream in the beautifully wooded valley of Nant-y-Môr. We had a fine view of a pair of Pied Flycatchers. We had next day very reluctantly to leave the mountains, and proceed to scenery of a very different kind. Bodorgan, our next head-quarters, is a primitive little village right in the centre of Anglesea. I must only mention very briefly the most interesting walks we took from here. The neighbourhood of the sand-hills, and grass-covered sand-flats round Llyn Coron, a large lake close to Bodorgan, is a rich one for plants. They stretch to the sea, a few miles distant, and in many places are faintly coloured by a little Centaury, *Erythræa littoralis*. Mixed with

these, and very similar in appearance, were plants of the compact dwarfed variety of the Common Centaury. Another rare plant, *Viola Curtisii*, is also so plentiful that it covers large tracts of the sand-flats with its yellow flowers, conspicuous enough, when occurring in masses, to be seen easily from the railway. Earlier in the season we should have seen the little Early Sand-grass (*Mibora verna*), which grows close to the lake. We boated a good deal on the lake, and dredged several Charas; *C. aspera* was the most plentiful, and formed large beds at the bottom of the water.

From the South Stack we had a fine view of a ceaseless procession of Guillemots and Razorbills, with a Puffin now and then, flying to and from the sea, from the cliffs opposite, where thousands of these birds sat, covering the ledges so thickly that one wondered where each new arrival could find a place. The Gulls breed close to the Lighthouse, which is built on the top of the rock, and the men protect the colony partially, that is to say, they never take *all* the eggs for eating. We photographed some of the nests, and a few young Gulls—beautiful soft little creatures—as they tried to hide themselves in the chinks of the rock. The old birds, Herring Gulls, shrieked very angrily over us, and one even struck with its wing a man from the Lighthouse who was with us.

On June 30th Mr. Griffith again very kindly had a day's botanizing with us. *Potamogeton lanceolatus*, a Pondweed found only here and in the Fens of Cambridgeshire, was the chief object of this excursion; this grew in the river at Lligwy, in dark green masses waving to and fro in the current, and looking very much like some sea-weed. On the extensive moors near, *Schænus nigricans* and *Carex filiformis* (not in fruit) grew, and in many of the marshes we saw the rich-coloured *Orchis incarnata*.

We now proceeded to Llandudno, and spent the last two days of our holidays there. The huge promontory of the Great Orme's Head, composed of carboniferous limestone, abounds in rare plants. On the part of the hill close to Llandudno we saw *Hypochaeris maculata* amid masses of

Geranium sanguineum and *Silene nutans*. Large patches of the Hoary Rock Rose, with delicate little flowers of bright yellow, grew plentifully all over the Head, but it was in only one place we saw the lovely blue spikes of *Veronica hybrida* and the dark purple flowers of *Epipactis atro-rubens*. Another very rare plant, and likely to be passed over, is *Valerianella dentata* var. *mixta*, which we came across near the above. We found also *Potentilla verna* and Wild Madder and Golden Samphire on the Great Orme's Head; and on the Little Orme's Head, which we visited on July 3rd, our last day, we gathered a rare Stonecrop, *Sedum Forsterianum*, conspicuous with its bright yellow flowers, and also saw the pretty little *Alsine verna*.

I must conclude by saying that we are indebted to Mr. Arthur Bennett for naming some of the plants shown, and especially to Mr. J. E. Griffith, of Bangor, by whose help alone we were in many cases able to see the rarest Welsh plants in their native home.

Mr. Bernard B. Gough read a 'REPORT OF EXCURSIONS FOR 1891':—

April 25th.—Thirty-three members and their friends met at Box Hill Station, and proceeded to visit the grounds of Deepdene. Among the large trees the Green Woodpecker was quite at home, and the party were constantly startled by its loud cry.

May 9th.—Fox Hills and Mitchet Lake. Although the weather was dull, and a slight shower had fallen early, twelve members were present on this excursion, Ash Station being the starting point. A course was taken leading through fine heathy and well-wooded country towards Pirbright. Here in the more marshy parts the Sweet Gale or Bog Myrtle made the air quite fragrant with its scent, and Sundew, Club Rush and *Carex pulicaris* formed the shorter turf. The curious insect-like note or song of a Grasshopper Warbler was incessantly heard, and a Redstart and Lesser Whitethroat told that summer was close at hand. A track across the heather took the party through wild, grand country to Mitchet Lake, a comparatively uninteresting piece of water.

A few ditches on the way to North Camp Station produced a few specimens of one of the rarer water Ranunculi (*R. tripartitus*).

May 30th.—An afternoon excursion to Farthing Down, Chaldon Church, and Alderstead Heath. Farthing Down is an open down, about a mile and a quarter in length, extending from near the Coulsdon Station in a south-easterly direction. Its greatest elevation is about 480 ft. The Down has the appearance of a rounded bank, having a valley on each side, but terminating on the S.E. with the upland country of the N. Downs. Several barrows are on the down, some of which have been opened. Several skeletons were found in one of them, all lying side by side, with the feet towards the east, giving an indication of Christian burial. Some drinking cups and silver pins were found, which are deposited in the Croydon Museum. In another barrow was a skeleton of a man who must have measured 6 ft. 5 in. There was also a sword, and bosses of a shield. The conjecture is that the date of the burials was about the 13th century. The walk continued through lanes to Chaldon Church, which was visited, and Mr. Gilford read an interesting description of the fresco on the inside wall of the church. After leaving the church, the walk was continued over fields to Alderstead Heath, and thence to Shepherd's Hill, from which was an exceedingly fine view of the country southward, extending to the S. Downs, and also westward to Leith Hill and eastward to Ashdown Forest.

June 13th.—To Oxted. Four members started from Redhill. At Oxted Station they met the Rev. Ernest Ellman, of Tandridge Rectory, who kindly conducted the party through the delightful woods in that neighbourhood. The day proved very fine, but the heat as the morning advanced became somewhat oppressive. The party turned north, and passing the well-marked strata of Upper Greensand, ascended the steep N. Downs by the side of a dense wood of fine beeches and yews. Here Herb Paris (*Paris quadrifolia*) was found in abundance in the shady spaces, several specimens having five leaves in the whorl, instead of the usual four. The wood

continued to the top of the hill, and was ascended by zigzag paths. Numerous specimens of Tway-blade and of the Large White Helleborine (*Epipactis grandiflora*) were seen. A few spikes of Fly Orchis were also found near the top of the woods.

On June 27th the members met at Gomshall Station shortly before 3 o'clock, and walked through the village of Albury, and along the high road to Chilworth Station. The whole distance, about five miles, lay over the Lower Greensand formation. The party numbered twenty.

On July 11th, five members, meeting at Grange Road, walked along the road to Hedgecourt Mill-pond, a sheet of water nearly half a mile long by a quarter of a mile wide, and mostly shallow. On the way, the note of the Wryneck and the Lesser Whitethroat's song were heard, although the summer was advancing. Honeysuckle was abundant in blossom. Spotted Palmate Orchises were plentiful, and Butterfly Orchises, both Lesser and Greater, were gathered. The pond lies in an extended flat, the general elevation of the land being about 230 to 250 ft. above the sea-level. On the N. side the margin was scarcely above the level of the water. Here grew *Cnicus pratensis*, *Sparganium neglectum*, Skull-cap, and Saw-wort. The rare *Viola lactea* was sought for and found, but in seed only. The yellow spikes of Bog Asphodel and *Drosera intermedia* grew in the wet ditches. On the way to Three Bridges a plant of the large and handsome Spurge, *Euphorbia Lathyris*, was noticed, which had sprung up on waste ground in a cottage garden.

July 25th. — Nine members and friends met at Coulsdon Station. The walk was towards Chipstead, and on the high land in its neighbourhood. The subsoil on this elevation is chalk, but covered with a coating of reddish brown clay. The general elevation above the sea-level is about 500 ft. On descending from the high ground the party reached the main road from Croydon to Merstham. Through this valley in former days ran a railway from Merstham lime-quarries to a canal at Croydon. Both have disappeared, but the course of the old line may be distinctly seen in many places, sometimes in a cutting, and further north on the side of the hill.

Aug. 22nd.—Buckland Hills. Betchworth Station was the meeting place of ten members. Here on the railway-bank *Campanula Rapunculus* was gathered in flower. The walk from Betchworth to Reigate along the chalk-hills is always a pleasant and varied one at any time of year. At the end of the summer one of its special charms consists in the abundance of some of the more showy of the chalk-loving plants by which the hill-slopes are made gay with bright colours. The common Ragwort was one of the most conspicuous, displaying fine masses of bright yellow. The St. John's-wort (*Hypericum perforatum*), Yellow-wort, and some of the yellow Composites also contributed; and among flowers of other colours the handsome drooping Musk Thistle, the Musk Mallow, Red Centaury, Marjoram, and Greater Knapweed were noticeable. In one place the parasitical Greater Dodder (*Cuscuta Europæa*) was found climbing over the stems and leaves of the Wood Germander, Greater Knapweed, and other plants; it is readily distinguished by the included styles. The curious little Ground Pine or Yellow Bugle (*Ajuga Chamæpitys*) was found in flower, and *Galium tricornis* in fruit. Gird Buntlings were in song.

Sept. 12th.—A party of ten arrived at Forest Row shortly before 11 o'clock, and walked across some meadows to Brambletye House, passing on the way one of the head waters of the River Eden, a stream with a deep watercourse, evidently liable to floods, as there were traces of the water having been four feet higher than at present. An old bridge which spanned the stream is said to date from the Conquest. The original house has long since ceased to exist, but the moat which surrounded it and defended it still remains. The more recent house dates back about 250 years, but it is now in ruins; the gateway or porch is left. There are the remains of four well-cut shells in stone, and some good carving in the porch. An arched descent into a basement storey is in good preservation, and the remains of a tower now clad with Ivy. Other portions of the building are covered with Ivy, the stems of which have acquired unusually large dimensions. There appears to be the remains of another moat,

which probably defended the more modern house. Leaving Brambletye, the party arrived by shady lanes at the height of Ashdown Forest. Parts of the Forest were very swampy. Here Sphagnum was abundant, with some plants of Sundew. Fine patches of Heather and Devil's-bit Scabious were quite features of the Forest. The party then crossing some picturesque streamlets, which cut their way through the Hastings Sandstone, reached "Northwood," where they were most hospitably entertained by W. J. Evelyn, Esq. Noticeable among other interesting objects here were a pair of very diminutive Indian Oxen; also splendid black, long-horned bulls, used on the estate for ploughing; and the Crimean Goose, with feathers long and thin, after the character of some of the inferior feathers of the Ostrich.

On the afternoon of the 26th of September a party of thirteen assembled at Betchworth Station, and walked to Brockham and the banks of the Mole. By the water's edge *Sparganium neglectum* was found.

EVENING MEETING.—DECEMBER 18TH, 1891.

Mr. W. H. Tyndall read a paper on 'BRITISH SPIDERS.'

The paper, which was of a descriptive character, was illustrated by diagrams.

Mr. Charles E. Salmon read a paper on 'THE NESTING OF THE NORFOLK PLOVER, AND ON OTHER SPECIES OF BIRDS':—

On the invitation of Capt. Verner, a well-known ornithologist, my brother and I left Reigate last May for a few days at Lydd.

Our chief object was to obtain photographs of some of the eggs of birds breeding on the shingle, and more especially to try and procure one of the nest of the Norfolk Plover, or Thick-knee.

Early the following day a start was made for a tramp on the "Holmstone," a great plain of pebbles, walking on which is greatly eased by wearing a couple of flat boards on the feet,

these are locally called "back-stays," and prevent the foot from sinking back into the shingle.

A boatman who accompanied us knew the whereabouts of a nest of Norfolk Plover, and with his assistance, after some searching, we were fortunate enough to spot the two large handsome eggs lying side by side on the stones, very difficult objects to distinguish among the pebbles.

This shy and retiring bird, the Norfolk Plover, is, according to Capt. Verner, rapidly becoming extinct in this neighbourhood, and only a very few pairs now remain to breed on the vast extent of pebbles.

By day the Thick-knee remains mostly inactive, turning over a few stones here and there in search of a stray beetle or slug; but at dusk it takes flight, and its curious weird whistle, perhaps best expressed by the word *turlin*, may be heard overhead, apparently at a great height.

After taking some shots with the Camera at the nest, a mile or so of tedious shingle-walking brought us to a fine Redshank's nest, placed in a hollow in a patch of grass, quite overhung by dried bents and sprigs of dwarfed Broom. This accounts for the somewhat unsuccessful photograph. The eggs, four in number, were placed point to point; a common feature in the Plover family.

"Carlo," Capt. Verner's dog, now proved himself an adept at finding Terns' nests on the shingle. This he did by sniffing along the pebbles until he could scent the birds, then, following the trail to the nest, he would come to a dead halt, and carefully lick the eggs.

In this way he discovered at least four Common Terns' nests, and also one Skylark's, a common beach-breeder, containing young.

Some little way ahead appeared a series of small ponds, and we were delighted at seeing, wading about in the shallow water, a fair-sized party of shore birds. Lying down flat upon the ground, for there was absolutely no "cover," and gradually wriggling ourselves along the short turf, taking advantage of every hillock and depression, and Carlo following our example, we managed to approach them very closely.

Watching through our telescopes, we could see every movement of a fine party of nine Turnstones, splendid fellows in bright breeding plumage, resplendent with red and brown, pure white, and coal-black. Here too, mixed with a few black-breasted Dunlin, six Bar-tailed Godwits were prodding the sand with their flexible bills; both these birds too were in fine breeding plumage.

A fine Widgeon Drake had joined them, and gave us ample opportunities for admiring its chestnut neck and the white on its head; and twenty-four Whimbrel were silently dipping their long, curved bills in the shallow water, evidently hunting for small molluscs or shrimps.

A few Redshanks, handsome birds with distinct, white markings, and one or two Kentish Plovers also were feeding here.

Next day the first item on our programme was to photograph another nest of Norfolk Plover, this time situated towards the lighthouse. It was, in all respects, similar to the one seen the day before, and, like it, contained two richly-coloured eggs.

This over, we made all speed to the shore, passing great clumps of the Nottingham Catchfly, which made a pleasant change from pebble walking, as it frequently formed patches several yards in extent. On nearing the coast we proceeded very cautiously, and, raising our heads above the last bank of stones, could see a little party of birds wading on the glistening stretch of sand. These included Dunlin, some Sanderling, and a few Ringed and Kentish Plovers. A log of wood gave capital cover, and we were able to watch their movements for some time, until, something alarming them, they flew off—flashes of black and white—round a bend of the high bank of shingle.

Hundreds of Common Terns floated overhead with their graceful, dipping, swallow-like flight, while here and there a Lesser Tern might be distinguished by its smaller size; both were uttering their harsh cries, and swooping down now and again to assure themselves their eggs were still safe. Ringed Plovers ran swiftly among the pebbles, and occasionally would fly past uttering their plaintive notes.

Shyer by far than all these were the Kentish Plovers, and it was only by very carefully examining the distant shingle with telescope that perhaps one or two might be seen. Watching thus for some time, and making no movement, we could plainly see several birds gradually approaching their nests, and eventually settling down on the eggs. Without any further trouble we were able to simply walk up to two Lesser Terns' nests, each containing two eggs (three is the full number), and we could have photographed as many Common Terns' nests as we wished.

The eggs of the Kentish Plover, however, required some little searching for, as the timidity of the birds had not allowed us to take as many bearings of the nest as we should have desired. The eggs of this bird are decidedly rare, as they only breed at a very few spots on our coast; they are laid sometimes on the bare shingle, but in this case in an old Tern's nest, and are beautifully scrawled over with black markings.

Carlo was now birdnesting on his own account, and showed us many Terns' nests with one or two, and sometimes three, eggs. Returning to Lydd, we just had time to photograph a Ringed Plover's nest on the shingle not far from the village before dusk set in.

The four eggs were laid in the usual star-shape, and were almost as hard as any to distinguish among the stones, and, although only a few feet from them, and looking straight at them, as we presently found, it was some time before we all caught sight of them, owing to their marvellous similarity to the pebbles around.

Mr. Salmon exhibited eggs of the Norfolk Plover, Common Tern, and other species. He also reproduced a portion of the Kentish coast showing the Terns' eggs laid amongst the pebbles.

EVENING MEETING.—JANUARY 15TH, 1892.

The following presentations were announced :—Reprint of a paper entitled ‘Contributions towards a Flora of the Outer Hebrides,’ by Mr. Arthur Bennett, F.L.S. ; presented by the Author. ‘The Rochester Naturalist,’ Jan., 1892.

Mr. C. E. Salmon exhibited specimens of nine species of plants obtained in Surrey, and presented the following record of localities :—

Claytonia perfoliata. Plentiful at Elstead. E. S. & C. E. Salmon.

Anthriscus vulgaris. Elstead. E. S. & C. E. Salmon.

Veronica montana. Plentiful on the Surrey side of the Kent Brook by the road from Edenbridge to Oxted ; plentiful about Dry Hill, near Edenbridge. E. S. Salmon.

Orchis Morio & *Allium ursinum*. By the stream that forms the county boundary not far from Scarlett’s Mill, near Cowden. E. S. Salmon.

Ruscus aculeatus. Tilburstow Hill, near Godstone. E. S. Salmon.

Cardamine amara. Very plentiful in several places near Haxted Mill, near Edenbridge. E. S. Salmon.

Galanthus nivalis. Copse near Mugshole, Chipstead, apparently wild. H. Binns.

Ranunculus Lenormandi. Witley Common. E. S. & C. E. Salmon.

Iris fetidissima. One patch in the middle of a hedge in Wray Lane. C. E. Salmon.

Smyrnium Olusatrum. Hedge-bank near West Horsley Church. C. E. Salmon.

Hottonia palustris. Near North Camp Station. E. S. & C. E. Salmon.

Medicago maculata. By Gomshall Station. C. E. Salmon.

Impatiens fulva. Gomshall Bog. C. E. Salmon.

Carex divulsa. Roadside at Gatton Park. C. E. Salmon.

Thlaspi arvense. Field at Chipstead towards the “Fox.” C. E. Salmon.

Galium tricornis & *Cuscuta Europæa*. Near foot of Buckland Hill. J. B. Crosfield.

Melilotus arvensis. Waste ground, Reigate Heath. E. S. & C. E. Salmon.

Sagina modosa, *Spiranthes autumnalis* & *Spiræa Filipendula*. Park Downs, near Banstead. C. E. Salmon.

Geranium striatum. Sparingly in the lane between Banstead and Chipstead. C. E. Salmon.

Saponaria officinalis. In a lane between Bletchingley and Nutfield Station. E. S. Salmon.

Galium Mollugo var. *insubricum*. Reigate Hill, near the Butts. C. E. Salmon.

Daphne Laureola. Godstone end of the railway cutting at Godstone Tunnel. E. S. Salmon.

Alyssum incanum. In a field between Chilworth and Shalford, where *Silene dichotoma* appeared. B. B. Gough.

Chara vulgaris b. *longibracteata*. Near Haxted Mill, near Edenbridge. E. S. Salmon.

Chara fragilis. Frensham Little Pond. E. S. & C. E. Salmon.—Duckpond by Shingle Barn Farmhouse, near Edenbridge. E. S. Salmon.

Chara aspera. In great quantity in pond on Hankley Common, near site of Abbot's Pond. E. S. & C. E. Salmon.

Nitella translucens. Ditch on Royal Common, near Milford. E. S. & C. E. Salmon.

Viola hirta var. *calcarea*, Bab. Abundant on Bletchworth Hill. C. E. Salmon.

Nasturtium officinale var. *siifolium*. Near Reigate Heath. E. S. & C. E. Salmon.

Mr. Poulter exhibited a piece of Meteoric Iron from near Bletchworth Clump.

Mr. A. J. Crosfield brought for exhibition some plants collected at Mentone; also six parts of Lord Lilford's 'Coloured figures of the Birds of the British Isles.'

Mr. W. H. Tyndall read 'METEOROLOGICAL NOTES, REDHILL, FOR 1891':—

The BAROMETER was not subject to many great fluctuations.

Only once, on the 11th of November, did it fall below 29 in. ; then it fell to 28·73 in. The maximum reached was on the 5th of February, 30·70 in. The average maximum was 30·45 in. ; the average minimum 29·44 in. Oxford Road stands about 300 ft. by Ordnance Survey above the level of the sea. For 185 days it reached 30 in. and upwards. On 179 days it reached 29 in. and upwards, but not 30 in., and one day it fell below 29 in. The average for the month of February was 30·43 in., the greatest of any month in the year. The lowest average was in October, 29·81 in., but the month of May was very close upon it, being only 29·82 in.

As to TEMPERATURE, the year generally was cool. Only on 2 days did the thermometer reach 80°, on the 18th of June and 7th of July. On 51 days, from the months of May to September, the temperature reached 70° and upwards. On 94 days, in the months of January to May and October to December, it fell to the freezing-point and under. In the year 1890, the temperature never reached 80° in the shade. It reached 70° on 52 days, and fell below freezing on 82 days. Comparing the temperature of the months with the average temperature of each month as recorded at Greenwich, it will be seen that considerable variation exists in some months:—

	GREENWICH.	REDHILL, 1891.	REDHILL, 1890.
January .	35·9°	33·15°	42·68°
February .	38·2°	37·88°	36·25°
March . .	41·8°	39·18°	41·44°
April . .	46·2°	43·62°	45·29°
May . . .	52·8°	50·59°	53·64°
June . . .	59·4°	60·24°	59·38°
July . . .	61·7°	60·41°	60·56°
August . .	61·3°	58·78°	59·38°
September .	56·3°	57·85°	59·24°
October . .	49·4°	49·67°	47·83°
November .	42·4°	41·57°	42·17°
December .	40·1°	39·81°	28·64°

The minimum temperature of the year was on the 9th of January, 9·5°, and the next coldest night on the 24th of December, 14°; last year the coldest night was on the 3rd of March,

8·5°, and the next coldest on the 28th of November, 9·5°. Redhill is doubtless colder than Greenwich, certainly colder than London. The thermometer did not rise above freezing on 10 days. The cold season of 1890 and 1891, which lasted from the 25th of November, 1890, to the 22nd of May, 1891, was not remarkable for the great intensity of the cold, but for its long continuance. It is to be borne in mind also there was great and unusual cold in October, when on the 27th the thermometer fell to 23·5°. The South-east of England had a mean temperature of under 30° for the whole period, whilst at Cambridge, and at Hillington, in Norfolk, the mean was about 28·5°; and at the sea-side stations of Kent, Sussex and Hants it was only 32°. In the extreme North of Scotland and in the West of Ireland the mean temperature was 10° higher than in the S.E. of England. In the cold district the frost penetrated more than one foot into the ground, and in many places the soil was frozen at 6 in. depth for above a month; it takes a lower temperature than 32° to freeze the soil when dry. As to the sea-temperature, on the coast of Sussex the temperature was 14° higher than the air on land; on the coast of Norfolk 12° higher; coast of Yorkshire 6°; N.E. of Scotland 8°; in the Shetlands 3°. In the Hebrides the temperature was the same; west coast of Ireland 3° to 5° warmer; in Cardigan Bay 13°; and at Scilly 9°. On the Continent the harbour of Toulon was frozen over for the first time on record; at Lisbon, the Tagus was frozen over, and the Ebro had 19 in. of ice. In London the ice stopped all progress of vessels between London Bridge and the Tower.

RAIN.—The year was remarkable for no rain falling at Redhill in the month of February. In fact, no rain to measure fell from the 1st of February to the 6th of March, 34 days; notwithstanding which the total rainfall of the year was considerably in excess of the average. The average fall at Redhill in a period of 25 years was 30·94 in. The total fall in 1891 was 36·57 in. March and May, which ordinarily are dry months, considerably exceeded the average, so did July and August. October was excessively wet, and December was very much above the average. The following table is a

comparison of the average rainfall each month at Redhill during 25 years, and the rainfall for 1891. Monthly falls exceeding 7 in. and exceeding 6 in. are also shown in the table:—

Average fall each month in 25 years, 1867 to 1891.		Actual fall in 1891.
January . .	2·98 in.	3·08 in.
February . .	2·14 „	<i>Nil.</i>
March . .	2·03 „	2·56 „
April . .	2·04 „	0·70 „
May . .	1·99 „	2·41 „
June . . .	2·13 „	1·76 „
July . . .	2·76 „	4·74 „
August . .	2·57 „	4·93 „
September .	2·88 „	1·15 „
October . .	3·45 „	7·11 „
November .	3·10 „	3·65 „
December .	2·87 „	4·48 „
Average annual fall in the 25 years .		30·94 in.
Amount of fall in 1891		36·57 „

Monthly falls exceeding 7 in. in 25 years.

1876. December .	7·24 in.
1880. October . .	7·48 „
1891. October . .	7·11 „

Monthly falls exceeding 6 in. during the 25 years.

1868. December .	6·63 in.
1876. January . .	6·86 „
1876. November .	6·50 „
1882. October . .	6·51 „

Average number of days in a year in which

·01 in. or more fell 178

Number of days in 1891 191

The average number of days on which ·01 in. or more rain fell is 178. The actual fall in 1891 was 191 days. As might be expected, there were some heavy falls in the 24 hours. The heaviest continuous fall was on the 10th and 11th of November, when 1·55 in. was registered; the next was on

the 20th of August, when 1·53 in. was registered. On October 6th, ·98 in. fell; on the 13th, ·88 in. On July 27th, ·86 in.; on the 1st of December, 1·02 in.; and on the 29th of January, ·77 in. On seven occasions 6 days consecutively and upwards passed without rain; and there were eleven occasions on which rain consecutively fell on 6 days and upwards. The longest drought was in February and beginning of March, as before stated; the next longest in April, from the 17th to 28th, 12 days. Rain fell each day from the 15th to the 27th of May, 13 days; from the 5th to the 23rd of October, 19 days; and from the 28th of November to the 15th of December, 18 days.

Snow fell on 9 days towards the beginning of the year; no snow fell in the autumn.

THUNDER-SHOWERS have been infrequent. There was thunder on the 27th of July, with heavy rain; distant thunder on the 10th of August, with some rain; again on the 22nd of September, with a slight shower; on the 7th, 13th, and 17th of October, and on the 13th with much rain.

Fogs were very prevalent in London from the 16th to the 24th of December; but at Redhill, though the nights and mornings were foggy, the sun shone during a great part of the middle of the day.

Heavy gales blew in the month of October, occasioning much loss at sea; but from Redhill being in a valley, the gales are not felt so severely as in a more open country. Heavy gales also occurred on the 7th, 10th, and 13th of December.

Mr. W. Gilford gave some information respecting the prospects of finding Coal in the South of England. He stated that a Search Syndicate has been formed for exploration between Dover and Somerset. At Dover six seams have been found, each one to two feet thick. The first is 1113 ft. below high-water mark. At a depth of 1544 ft., good, bright-blazing Coal is said to be found, corresponding to the French and Belgium Coalfields. At a depth of 1810 ft. is a seventh

METEOROLOGY. — OXFORD ROAD, REDHILL, SURREY (1891).

BAROMETER.				THERMOMETER.						RAIN.			
Month.	Max.	Date.	Min.	Date.	Max.	Date.	Min.	Date.	Average.		Mean.	Total of Month.	No. of Days -01 fell.
									Max.	Min.			
Jan. .	30·64	11	29·50	21	50·5	31	9·5	9	38·32	27·97	33·15	3·08	15
Feb. .	30·70	5	30·01	26	57·0	27	21·5	21	46·09	29·66	37·88	0·00	0
March	30·41	4	29·28	11	57·0	2	17·5	11	45·84	32·51	39·18	2·56	15
April .	30·27	20	29·51	5	63·5	28	29·0	17	51·87	35·38	43·62	0·70	10
May. .	30·25	12	29·37	18	76·0	13	30·5	16	59·81	41·37	50·59	2·41	19
June .	30·42	14	29·80	4	81·0	18	37·0	11	70·30	50·18	60·24	1·76	12
July .	30·31	14	29·66	30	80·0	17	43·5	27	70·07	50·76	60·41	4·74	19
Aug. .	30·20	8	29·26	21	74·0	14	40·0	29	67·20	50·36	58·78	4·93	23
Sept. .	30·37	16	29·59	1	78·5	13	40·0	27	66·88	48·83	57·85	1·15	14
Oct. .	30·63	31	29·20	22	65·5	1	26·0	30	57·03	42·31	49·67	7·11	23
Nov. .	30·59	5	28·73	11	55·0	1 & 18	25·0	27	47·82	35·33	41·57	3·65	19
Dec. .	30·66	19	29·32	10, 13	56·0	4	14·0	24	45·90	33·73	39·81	4·48	22
Year.	30·70		28·73		81·0		9·5				47·73	36·57	191

seam 2 ft. 3 in. in thickness. The aggregate thickness of the seven seams is 14 ft. 6 in.

Mr. James B. Crosfield mentioned that during the late frost hundreds of Gulls frequented the Thames up to Waterloo Bridge. Those he was able to identify were Black-headed.

EVENING MEETING.—FEBRUARY 26TH, 1892.

The company of young people was specially invited.

Mr. Fred. Enock gave a popular lecture illustrated by admirable lantern slides on 'THE HESSIAN FLY.'

Mr. Enock gave a most careful and minute account of the life-history of the Hessian Fly, an insect which has been known in America for 150 years, but only made its appearance in England about six years ago. Its ravages in fields of barley in America are most serious. In our country, owing to climatic causes, it does not seem likely to be nearly so dangerous a foe to the farmers, though it does much damage.

Mr. Enock showed on the screen diagrams of the fly in all stages. The female fly deposits her eggs in the stem of the barley. The larva turns itself within the sheath of barley by means of beautifully adapted knotted organs, and at each stage exhibits most exquisite adaptations to its surroundings.

EVENING MEETING.—MARCH 18TH, 1892.

The following presentations were made :—'Transactions of the Burton-on-Trent Nat. Hist. and Archæological Society, 1892.' 'Report and Proceedings of the Belfast Nat. Hist. and Philosophical Society, 1890—1891.' 'Transactions and Journal of Proceedings of the Dumfriesshire and Galloway Nat. Hist. and Antiquarian Society, 1890—1891.' Tunbridge Wells Nat. Hist. and Philosophical Society, 'Annual Report' for the year ending 30th of September, 1891.

Mr. Arthur Bennett, F.L.S., of Croydon, read a paper entitled 'A BOTANICAL RUN THROUGH THE FENS':—

The Fens of East Anglia include parts of Lincolnshire, Cambridgeshire, and Norfolk, and smaller portions of Suffolk and Huntingdon.

To those who have never visited these parts of England, no idea can be formed of the peculiar charms that come over one when wandering among them in summer. They are not like bogs or marshes, and yet they are very wet in places, and the extreme flatness, and width of view, especially in parts of Cambridgeshire, is so unlike anything one sees elsewhere.

Before good old Richard de Rulos attempted to drain Deeping Fen, the fen stretched for miles, one vast area of waving reeds, interrupted here and there by sheets of water, from half-an-acre, to others of two to three miles in circuit, abounding with pike, perch, ruffs, bream, tench, dace, and eels in particular, and the bird-life was wonderful in its extent and numbers.

These sheets of water had very curious names, some of those in the East Fen, in Lincolnshire, were called Cherry Burn, Hart's Booze, Cow Mouth, Bill Water Clotton, &c. Their waters communicated with each other by long reedy dykes, very similar to what may still be seen between the rivers and the Broads in Norfolk; and delightful places they are on a hot day in summer.

The draining of the Fens was not completed without great opposition; this is very well portrayed in a popular book called 'Dick o' the Fen,' in which the digging of the great dykes is well described and illustrated. One can well understand the wrath of the old men especially, to see their roaming over the wastes spoiled, their shooting wild fowl, bobbing for eels, and listening to the "Holland Waits," or Lincolnshire Nightingales (*i. e.*, the Frogs).

Now we will suppose we start for a botanical excursion in the Fen county, and if anyone does so, let him provide himself with a jumping-pole. The Fen is intersected with numerous narrow and wide dykes or drains, which all empty into what is called The Drove, or principal drain.

Wicken Fen is the only large piece of undrained Fen in Cambridgeshire. There is still a small portion in the same undrained state at Wimblington-in-the-Firelots, near Manea. We are now on the Fen, and the first plant we shall be likely to notice is *Cladium Mariscus*; this constitutes the main part of the herbage, and is cut as an uncultivated crop, and sold for thatching; formerly the fires at the colleges in Cambridge used to be lighted with it, but since Burwell and Reece Fens have been drained it is rarely seen. Along with it *Schenus nigricans* is very abundant, and here and there small clumps of *Calamagrostis* will be seen.

Scattered pretty freely about will be seen the beautiful metallic-blue flowers of *Lathyrus palustris*, and close by *Peucedanum palustre* in great abundance sometimes; in all directions *Valeriana dioica* will be seen, and now we are stopped by a dyke, and delve into it and bring up *Utricularia minor* and *U. vulgaris*; and in one spot only, so far as I have seen, *U. neglecta*; clinging to these will probably be *Chara polyacantha*, which is extremely abundant, quite filling up some of the pools with a dense mass of vegetation. Had we been earlier we should have found *Viola stagnina* in plenty. Close by is a cross-drain, and fringing this *Sium latifolium*: *Ranunculus Lingua*, and *Stellaria glauca* abound, and on the water the Water Lilies, white and yellow, with several species of *Potamogeton*, especially *P. plantagineus*. On the banks *Lastræa Thelypteris* by hundreds, with *Carex paradoxa*. Instead of crossing, we will follow the dyke down to the drove, and fringing this, about six inches under water, we shall see little rounded masses of a curious little, rare plant, *Nitella tenuissima*; thousands might be gathered, for though rare so far as regards its distribution, it is very abundant where it does occur. In 1857 *Senecio paludosus* was found on this Fen, and roots were planted in the Cambridge Botanic Garden; unfortunately they are now lost, and although I have myself searched two-thirds of the Fen, and last year got my friend, Dr. Leitch, to search the remainder, it has not yet been refound, and I and my friends have been equally unsuccessful in Norfolk and Suffolk.

I much fear this is really extinct, and yet considering the amount of enclosure, drainage, and cultivation that has gone on only in this last century, it is wonderful we have lost so few plants as we have.

Still, there are remote parts of the Broad country that may even yet produce it, as I am glad to say it does its old companion, *Senecio palustris*. This also seems extinct in Cambridgeshire, but in Suffolk, and especially Norfolk, it is, I am glad to say, fairly abundant in some three stations, and I have seen as many as thirty specimens in full flower at once, and that where it is not likely to be disturbed by drainage or cultivation for many years, for the ground is so wet that it is impossible to get to it without a boat, and then it needs care in walking about.

Sonchus palustris is also, I fear, another Cambridgeshire plant that is lost, but in Suffolk and Kent it still holds its own. *Teucrium Scordium* is still to be gathered near Mepal and Ely.

Many of the Fens around Wicken (such as Reche and Burwell) used to produce *Liparis Loeselii*, the Fen Orchis, but now it has become exceedingly rare there, but in another part of the county, on the borders of Suffolk, it occurs in plenty. With my friend from Chatteris we could have gathered it by thousands, and not hurt the station. Here it grew among *Cladium*, *Pinguicula*, *Carex filiformis*; in fact, it had not been gathered in Cambridgeshire for twenty years until we found it in this spot. Chippenham Moor is one of these spots, and here around the Fen, on a raised bank, grew the *Selinum Carvifolia*, found only a few years ago by Mr. Cross, of Ely, and which we gathered with the *Liparis*. Mr. Cross, Mr. Marshall, of Ely, and Mr. Potter, of Cambridge (Prof. Babington's assistant), all consider it native; my friend and I consider it was introduced into a planted belt of trees some eighty or ninety years ago; this raised bank is different to the Fen-land, and looks artificial, as though made to afford the trees a growing place, as the Fen would then have been far too wet for them to grow in.

Those who delight to see our rare plants preserved will be

glad to hear that the *Liparis* is also abundant in at least two stations in Norfolk, in one I saw it literally by hundreds in the space of this room, and in Suffolk Dr. Hinds has seen it in three Fens.

Mr. Bennett exhibited specimens of the following plants:—*Lathyrus palustris*, *Senecio paludosus*, *Cladium Mariscus*, *Senecio palustris*, *Sonchus palustris*, *Teucrium Scordium*, *Schenus nigricans*, *Peucedanum palustre* (the food of the Swallowtail larva), *Liparis Loeselii*, *Utricularia vulgaris & minor*, *Viola stagnina*, *Nitella tenuissima*, *Selinum carvifolium* (doubtfully indigenous).

EVENING MEETING.—APRIL 8TH, 1892.

Part No. 2 of 'Natural Science,' and the April number of the 'Rochester Naturalist,' were presented.

Mr. W. Gilford, on behalf of Mr. Cowen of the Philanthropic Farm School, presented some bones from the Wiggy sand-pit, including the teeth of an Elephant. Dr. Bossey stated that they probably belonged to the drift overlying the Folkestone Beds.

Mr. B. B. Gough exhibited a living specimen of *Gordeus aquaticus* found in Mrs. Ashby's pond at Redhill.

Mr. A. Dowsett, of Reading, gave a 'BIRD DEMONSTRATION.'

He described the various races of Owl, illustrating his remarks with a fine series of skins. He said that the whole of the Owls might be divided into two sections.

I. The White Owls, or *Strigida*, in which the furculum is united with the keel of the sternum.

II. All the other Owls; all of which have the furculum free.

Owls have very small bodies, and soft, lax plumage. A bird called the Guachero links the Owls to the Nightjars.

Count Salvadore places the Owls next to the Parrots, though they have few points in common, except that both breed in holes, and lay white eggs, and feed themselves with

their feet. Parrots are grain eaters, with the exception of the Keah of New Zealand, which has acquired a taste for mutton fat.

The Barn Owl may almost be described as cosmopolitan, though it is essentially a tropical bird, occurring within 40° north and south latitude, and only crossing that boundary in western Europe, where it is found in England and Norway. It has not yet been found in China, Japan, or Persia.

Various sub-species of Barn Owl have been described. A form with a white tail is peculiar to England and Jamaica. The Danish form with a dark tail is found occasionally in England. The Mediterranean type has been described under the name *Strix meridionalis*; and the Indian form as *Strix javanica*. In the West Indies and Cape de Verde Islands a race occurs with a very dark rich-brown breast.

The Barn Owl of St. Domingo has a silvery-grey face; that of Jamaica is a large, richly-coloured bird. In the Southern States of America the Barn Owl has a closely spotted breast. In Australia and Fiji a very pale Owl, *Strix delucatulula*, is found. The largest of the Barn Owls is *Strix Rosenbergi* from Celebes. It has very powerful feet.

The Javanese Barn Owl usually nests in holes of trees or wells; the Buenos Ayres bird in banks; and that from California in cliffs.

Owls as a rule are most voracious feeders. A Javanese Owl kept in confinement most rigidly refused to touch the flesh of raptorial birds.

The Tawny or Wood Owl (*Syrnium aluco*), occurs in the British Isles in two distinct types; a rufous and a grey form. The rufous type is more abundant in the South of England. Both types are found together in the North of Scotland. The grey type is generally found in dry districts; the rufous in warm, damp districts. In Palestine the Wood Owls are all of the grey type. A specimen from the neighbourhood of Constantinople exhibits strong tendencies to melanism.

In Argyle the Wood Owl has twice been found nesting in rabbit burrows. It often uses an old squirrel's dray, and has been known to breed in a deserted dog-kennel. It is a very

useful bird from the quantities of field mice it destroys. It is rarely found beyond 60° north latitude.

Bubo maximus, the Eagle Owl, occurs over Europe to the Himalayas. The same type is also met with in China, Japan, and Corea. In Siberia a larger form is found. This bird is found as a fossil in the Norfolk beds. In Palestine and Egypt it is replaced by the Egyptian Horned Owl. It nests on ledges of mountain rocks. It is abundant in Spain. Its flesh is white, tender and well flavoured. *Bubo Virginianus* replaces the Eagle Owl in America.

The Snowy Owl ranges northward beyond the limits of forests. Some birds of this species are much whiter than others. This is not accounted for by age but by individuality. When food is abundant, Snowy Owls are often prolific, laying as many as ten eggs. Fossil remains of this bird have been found in Kent's hole cavern, Torquay.

The Short-eared Owl is a migratory species in England. It is almost cosmopolitan, but is absent from Australia, New Zealand, and most of Oceania. It is met with, however, in the Sandwich Islands.

Tengmalm's Owl occurs in the Rocky Mountains, in Lapland, and the extreme north; it is replaced by a closely allied species, the Saw-whet Owl, in the southern parts of America. Unlike most Owls its call is a whistle. In this, as in many Owls, there is a want of symmetry between the two ears, the two sides of the skull being of different shapes.

The Long-eared Owl is found in Europe south of lat. 64°, and extends into Asia as far as India. It is plentiful in Palestine. It is reputed to be good eating. It is a habit of the bird to sit very close upon its eggs.

The Hawk Owl ranges up to the northern limits of forests. It is a day Owl, and lacks the facial disk. The American form is barely separable from the European.

The Ural Owl also extends to the limits of forests. A form of it is found in Japan.

The Burrowing Owl of America lives in the deserted holes of the prairie-dogs.

ANNUAL MEETING.—OCTOBER 21ST, 1892.

The Annual Report and Balance Sheet were read and adopted:—

HOLMESDALE NATURAL HISTORY CLUB.

Annual Report, October, 1892.

A new departure in the history of the Club during the past year has been the holding of three of the Evening Meetings at Redhill. The average attendance at these three meetings was twenty-one, being almost exactly the same as the average attendance at the three ordinary meetings held at Reigate. At the meeting in February, to which young people were specially invited, about sixty were present. On that occasion Mr. Frederick Enock gave a most admirable lecture on the life-history of the Hessian Fly.

Papers have been read, or addresses given, on the under-mentioned subjects:—

Oct. 16th, 1891. 'Curious Flowers and their Fertilization,' by Mr. N. E. Brown, of Kew.

November 20th. 'Three Weeks' Holiday in North Wales in pursuit of Natural History,' by Mr. E. S. Salmon. A Report on 'The Summer Excursions of the Club,' by Mr. B. B. Gough.

December 18th. 'British Spiders,' by Mr. W. H. Tyndall. 'The Nesting of the Norfolk Plover,' by Mr. C. E. Salmon.

January 15th, 1892. 'Meteorological Notes for 1891,' by Mr. W. H. Tyndall. 'The Coal formation in the South-east of England,' by Mr. W. Gilford.

February 20th. 'The Hessian Fly,' by Mr. Enock.

March 18th. 'A Botanical run through the Fens,' by Mr. Arthur Bennett, F.L.S.

April 8th. 'A Bird Demonstration,' by Mr. A. Dowsett.

During the year several exhibits were made of various objects of interest by Mr. Cooper, Mr. B. B. Gough, and Mr.

Cudworth; and specially beautiful specimens of dried flowers were exhibited by Messrs. E. S. & C. E. Salmon.

Dr. Bossey exhibited through a microscope good specimens of *Plumatella* obtained from the upper large pond on Earlswood Common.

Twelve outdoor excursions were planned; six whole-day excursions, and six half-day:—

Whole-day Excursions.

May 7th. From Gomshall to Abinger and Leith Hill.

June 11th. To Kew Gardens, when Mr. Brown kindly attended the party of visitors, and added greatly to their interest by the valuable information he gave.

July 13th. To Gomshall, Newland's Corner, and Chilworth.

August 6th. To Tunbridge and the Medway, in conjunction with the Tunbridge Wells Natural History Club. The Club is greatly indebted to Dr. Adeney, of Tunbridge Wells, for the trouble he took in kindly making arrangements.

September 10th. To West Hoathly, thence to East Grinstead.

October 8th. To Chilworth, Ewhurst Mill, and Gomshall.

Afternoon Excursions.

April 23rd. From Godstone Station, under Tilburstow Hill, to Bletchingley, thence to Nutfield Station.

May 25th. To Penshurst Place, when a large party attended.

June 25th. To Reigate and Betchworth Hills, thence to Betchworth Station.

July 23rd. To Ifield Mill pond, near Crawley.

August 20th. To Betchworth Park and Brockham.

September 24th. To Worth and Tilgate Forest.

Donations as under were received by the Club during the year:—From W. J. Evelyn, Esq., specimens of *Sirex gigas*. From Mr. Cowen, teeth of *Elephas*, and other bones from

Wiggy sandpit. 'Report of the British Association for 1891'; presented by the Association. 'Report and Transactions of the Cardiff Naturalists' Society for 1890'; presented by the Society. Paper entitled "Contributions towards a Flora of the Outer Hebrides," by Mr. A. Bennett, F.L.S.; presented by the Author. Paper on "Nomenclature of Potamogetons," by Mr. A. Bennett, F.L.S.; presented by the Author. 'The Rochester Naturalist, 1892'; presented by the Rochester Naturalists' Club. 'Transactions of the Burton-on-Trent Nat. Hist. and Archæological Society, 1892'; presented by the Society. 'Report and Proceedings of the Belfast Nat. Hist. and Philosophical Society, 1890—1891'; presented by the Society. 'Transactions and Journal of Proceedings of the Dumfriesshire and Galloway Nat. Hist. and Antiquarian Society, 1890—1891'; presented by the Society. Tunbridge Wells Nat. Hist. and Philosophical Society, 'Annual Report for the year ending 30th Sept., 1891'; presented by the Society. 'Report and Transactions of Penzance Nat. Hist. and Antiquarian Society, 1891—1892'; presented by the Society. 'Proceedings and Transactions of the Croydon Microscopic and Natural History Club, Feb. 1891—Jan. 1892'; presented by the Society.

Five members and five subscribers were added to the Club during the year; seven resigned. The present membership is seventy.

THE HOLMESDALE NATURAL HISTORY CLUB.

ABSTRACT OF ACCOUNTS.

<i>Receipts.</i>			<i>Expenses.</i>		
Oct. 1891, to Oct. 1892.	£	s. d.	Oct. 1891, to Oct. 1892.	£	s. d.
Balance	3	0 10	Footpath Association.	0	10 0
Subscriptions	25	0 0	Rent, Gas, and Clean-		
Donations	8	1 0	ing	18	1 1
Sale of 'Proceedings.'	0	3 0	Printing, &c.	2	12 8
			Lectures	4	4 0
			Insurance	0	9 0
			Collector's Commission	1	1 0
			„ postages, &c.	0	5 3
			Balance	9	1 10
	<u>£36</u>	<u>4 10</u>		<u>£36</u>	<u>4 10</u>

The following Officers were elected for the ensuing year:—
President, Mr. W. H. Tyndall; *Treasurer*, Mr. J. I. Cudworth;
Secretary, Mr. A. J. Crosfield; *Curator*, Mr. J. Linnell; *Committee*, Messrs. J. Bonnor, T. Cooper, J. B. Crosfield, F. H. Ellwood, J. Knight, E. S. Salmon, C. E. Salmon, Rev. W. M. Paull.

The President nominated Dr. Bossey as Vice-President.

It was decided to hold three meetings at Redhill during the winter season.

Mr. C. E. Salmon exhibited a specimen of *Helvella crispa*, a fungus which he found in Margery Grove.

Mr. Henry M. Wallis, of Reading, read a paper on 'THE DESCENT OF BIRDS.'

The paper was illustrated by a fine series of diagrams. It brought very prominently forward the various links in the chain of evidence which tends to support the theory that birds had a reptilian ancestor. A large number of most interesting facts in illustration of this were brought forward, and a comparison was drawn between the Dinosaur, Iguanodon, Archeopteryx, Hesperornis, and other extinct forms of life.

EVENING MEETING.—NOVEMBER 18TH, 1892.

Mr. T. Cooper exhibited living specimens in flower of three species of *Mesembryanthemum* from the Cape. They all had fleshy stems, and small pink blossoms.

Mr. A. J. Crosfield produced a bunch of flowers gathered the same day in his garden containing 41 species, including amongst others *Ajuga reptans*, *Vinca minor*, *Petasites fragrans*, *Alchemilla vulgaris*, *Campanula rotundifolia*, *Ænothera bieninis*, *Dianthus gallicus*, and *Allium fallax*.

Miss Horne exhibited some dried plants from Switzerland, and Mr. Brass exhibited some dried plants from Palestine.

Mr. Ernest S. Salmon reported having seen on Oct. 30th, a Great Grey Shrike on Walton Heath.

Miss Martin read a paper entitled 'A MONTH IN THE CANARIES':—

I fear I am hardly scientific enough to be worthy of the privilege now accorded me; I can only plead an exceeding love of Nature, and an observation from my earliest years of several branches of Natural History. Accompanied by one of my nieces, I spent a month in the Islands of Teneriffe and Palma, from the end of April to the end of May, in the present year; and having met with much that was new and interesting to myself, I am not without hope that an account of what I saw may prove of interest to other members of our Club. You would all know that the Canary Islands, or the Fortunate Isles,—partially discovered and dreamed of in ancient times,—so-called, are seven in number, lying in about the 28th degree of latitude, and as the desire of my whole life had been to see tropical scenery, I took flight to these islands as the nearest approach to it which came within my reach. Teneriffe, the largest of the group, has one grand and noble feature which distinguishes it from all the rest, namely, a solemn snow-crowned peak rising to the height of 12,000 feet. This mighty peak has been a volcano, and from time to time smoke and flames have issued from its crater, and streams of burning lava have flowed down its sides. But it is more than one hundred years since the last eruption, and whatever may be the inward fires, outwardly all is peace. The slumbering giant looks down placidly on a valley so rich and fertile (called by Humboldt one of the most beautiful in the world), and a climate so soft and balmy, that invalids from northern lands are glad to come and dwell there.

For Teneriffe knows not our English fogs and frosts, nobody shivers over the fire at night, or finds ice in her bedroom in the morning, and as you look over the flat roofs of the houses no such things as chimneys are to be seen. It is a land of perpetual summer: during the month we were there the thermometer, indoors and outdoors, night and day, never varied more than from 68° to 72°, and the whole of the difference between winter and summer is but ten degrees. Ladies can wear thin dresses all the year, and

sit in the verandahs after a late dinner, even at Christmas-time.

A voyage of six days from Southampton lands us at Santa Cruz, the port of Teneriffe. If the horizon is clear, the peak may be seen seventy or even one hundred miles out at sea, but *we* saw it not. The peak hidden, there is nothing very striking in the rocky mountainous coast with its fringe of Tamarisk trees, as the vessel glides into the harbour. But once on shore, and once beginning to mount the ascent which lies at the back of the town, we realize that we are indeed in a southern land. Oratava is *the* place of resort, and to reach it you have to drive twenty-five miles, and mount 2000 feet over the ridge which separates the two sides of the island. And a delightful drive it is, fresh and novel to English eyes. Eucalyptus, Pepper trees, Locust trees, such as are seen in the Riviera, line the road; Fig trees of luxuriant green nestle in the nooks, masses of Scarlet Geranium almost dazzle with their brilliancy; a few Palm trees stand up against the blue, cloudless sky, while below, in wider and wider vision as we ascend, lies the sea, ultra-marine in colour, bounded by Gran Canary, the next largest island, 60 miles away.

As we mount the air grows cooler, and at the summit of 2000 feet we get into mist and rain. But presently we pass out of this, and begin to descend, and soon return to blue sky and sunshine. Then far below lies stretched out the valley of Oratava, with the sea again in all its depth of colour; only now it is the other side—the western side of the island with nothing between us and North America. The first view of the far-famed valley is a little disappointing, perhaps because my dreams had pictured it a mass of wild, luxuriant, tropical vegetation. Instead of that, hardly an expanse of English landscape could be more carefully laid out in cultivation. It is broken up into small patches of cultivated ground, without the softening effects of English hedgerows to divide them. True, the vast semi-circle of volcanic rock, which shuts in the valley, is grand and imposing; but with the peak in the clouds, as it constantly is, the best feature of all is wanting. In this case we find distance does *not* lend enchantment to

the view, for as we descend it is the *detail* which becomes "enchanting." Every step is a marvel of delight to the lover of flowers, and especially of flowering shrubs. There are so many new friends, and many old ones dressed up so brightly we hardly know them! Amongst the former are the Scarlet Hibiscus, with its brilliant blossoms, the glorious Bougainvillea, with its different shades of mauve and crimson, the purple Wigandia, which was entirely new to me; yellow Mimosa, or Acacia; here and there an Orange tree laden with fruit, here and there a tall Palm; then there are Oleander, Red Geraniums, and Poinsettias, apparently wild along the roadsides, Roses in clusters, and Honeysuckle hanging from the trees, and Plumbago from the house-roofs; Heliotrope, Abratalon, in masses in the gardens; fields of pale green Bananas, brighter green Maize, Tobacco, and Sugar-cane. I do not know whether anybody here has ever visited Oratava; if they have, they will be able to recall the beauty of it all; if not, well, perhaps they will be wishing themselves there!

The little town of Oratava lies close to the sea, and behind it the ground rises gradually for five or six miles till it reaches the mighty barrier of rock 7000 to 9000 feet high—a few Pines in the ravines, but mostly bare and seamed and scarred—which shuts it out on that side, like a circling arm, from all the world beside. From behind this rises up the peak,—a snow-covered cone in the coldest part of the year, but parting with its mantle in the full summer; the limit of perpetual snow in this latitude being 12,500 feet. But it is by no means a constant sight; not Snowdon itself is more frequently enveloped in cloud. They who would see it at its best must be on the alert at four, five, or six o'clock according to the season. From the housetop of our hotel, which was my almost daily resort from 4.30 to 5, with the soft balmy air, the vivid colouring of earth and sea, the green valley in shadow, and then the rising sun catching first the peak and then point after point of the other mountains; from that housetop I have carried away some of the sweetest impressions of my life. The sun at setting too is striking to the northern eyes;

it seem to go down so suddenly into the sea, and the very instant it is gone darkness begins to fall, one is conscious at once of gathering gloom. After a little while comes a beautiful afterglow, and the chorus of the Frogs from every tank and water-course begins too.

Returning to the Flora of the Canaries, I was surprised to see so many of our English wild flowers growing under the shadow of the Palms, or on the borders of the Sugar-cane or Banana plantations. It is true I never met with either Daisy or Buttercup, for there are no meadows like ours, and though there may be grass on the mountains it is dry and stunted, and utterly unlike the vivid and rich growth of our pastures. There is very little rain or moisture, and the fertility of the country is only kept up by constant irrigation. For this purpose the water that is abundant in the cloudy upper regions is brought down in small channels and stored in tanks below.

Amongst our British species are the small Mallow, common Fumitory, wall Pellitory, hedge Parsley, scarlet Poppy, blue Pimpernel, Agrimony, wild Mignonette, and, most noticeable of all, abundance of Bracken and Bramble bushes. The wild flowers unknown to us are interesting, but nearly all allied to our own species. A pretty mauve *Convolvulus* is universal, also a handsome crimson *Pea*; then there are *Irises*, blue and white, different coloured *Mesembryanthemums*, *Datura*, and *Tomato*. The *Opuntia*, or Prickly Pear, which covers all the waste ground, was originally introduced for the sake of the cochineal insect, of which it is the food; that industry has now been abandoned, but the Prickly Pear remains with its red or orange blossoms standing quaintly out of the leaves. Other strange *Cactus* forms there are, especially one with tall straight stems growing together candelabra fashion. The American *Aloe* often serves as a fence, and the Canary Spurge, an ungainly plant, occupies, like the *Opuntia*, the uncultivated places.

Two trees peculiar to the islands are found, the Canary Laurel and the Canary Pine, both of them large and handsome, but growing more luxuriantly in the island of Palma,

and also, I believe, in Gran Canary, than in Teneriffe. The Vines are planted in little terraces, but are allowed to grow mostly at their own wild will. Plane trees are placed alternately with Eucalyptus along the roads, and there are a few Horse-chestnuts and Spanish ones in certain spots. Fig trees also are abundant, so that even in this land of continual summer a few fading and falling leaves may yet be seen. Probably higher up in the interior, there may be more deciduous trees; my experience only extends to the lower regions. Except one or two excellent roads, there are only mule tracks to the less frequented parts of the island. The celebrated Dragon tree I cannot attempt to describe, it is so strange and weird, so unlike anything one has ever seen before. There are many small specimens, but *the* special one is at Icod, a picturesque little town along the coast, twenty miles from Oratava. It is said to be a species of Asparagus, but to the casual observer there is not the least resemblance. It is said also to be 3000 years old, so that one looks at it with intense *respect*, if not with admiration. The drive to Icod is charming; the sea on one side and the mountains and ravines on the other make it almost like the Riviera; there is more water left to its natural flow, and not cramped into narrow channels as elsewhere, for irrigation purposes, while from underneath the rocks, where there is shade and moisture, you may gather such armfuls of Maidenhair as even the Riviera does not know. The fruits of this favoured region are as abundant and perpetual as the flowers; Bananas are to be had all the year round, Oranges a great part of the year, and in May, the time we were there, there were on the tables beside these, fresh Figs and Dates, Loquats, Pears, and Cherries. In June the Peaches, Nectarines, and Apricots are ripe, and in July comes the vintage. Everything of course is earlier than with us; in April and May tons and tons of Potatoes, also Tomatoes, are taken by every steamer to the London markets, and the soil is so fertile, as well as growth so rapid, that we were told five crops could be raised successively from it in the same year. Nature seems always at work, and never to retire for rest, or rather for work underground, as

she does with us in the winter. But all depends on the *irrigation*, as we have said.

The Botanical Gardens are a delightful place of resort at Oratava. They are supported nominally by the Spanish Government, and though with pay sadly in arrears, are admirably kept up by the manager, a German. Plants and trees from afar—from the North and the South, and from the Tropics as far as possible—are here naturalized. Australian and New Zealand Palms figure largely; the Bamboo, Papyrus, Guava, Coffee, all interesting, are there, and many strange unfamiliar forms, bounded with Myrtle hedges, blend with fragrant and lovely creepers and brilliant-blossomed shrubs. It is Kew in the open air—and such delicious air—with the solemn peak, and the circling rocks, looking down upon all. And yet another attraction have these gardens, they are a Paradise of *birds*! Outside the Paradise I had been again disappointed. My dreams had failed of fulfilment, and even *inside* the enchanted enclosure, it was dear old friends who greeted me more than new ones. With one exception; for the first time I heard and saw a *real* wild native Canary. A Canary who had never known a cage. But he was very different from what I had expected. There was no gleam of gold through the branches; it was only a small plain bird of dark olive green, whose little throat was pouring out the song, utterly unmistakable, so often heard at home. It seems remarkable that while man, alchemist-like, has transmuted the sober plumage into gold, Nature still holds fast to her original idea, and refuses to re-make the melody. But the Canary is by no means a solitary performer. There may be one or two of his own race, but the concert is mainly composed of old familiar voices which we have loved (some of us) all our lives. I never heard so many Blackcaps singing together, hardly so many Blackbirds, while Chaffinches and Chiffchaffs fill up the pauses; it is a feast of song indeed, repeated day by day. And one very pretty sight is that of a mother Blackcap sitting on her nest in a Mimosa tree, while the black head of her mate is visible on an adjoining branch as he sits there and sings his sweetest. The

wild Canary does not seem abundant, though almost every house has one in a cage. The Chaffinch and the Chiffchaff are to be heard and seen everywhere. An elegant species of Wagtail is also common, with yellow on its breast, yet not exactly like either our Yellow or our Grey Wagtail. A pair of them were my constant companions on the housetop while watching and waiting for the sunrise. Also a pair of Sparrows. Yes, actually these two Sparrows, bright, clean respectable birds, sprightly, but not saucy, were the only Sparrows I saw in the islands. I cannot explain the fact nor guess what had become of the rest of the tribe. Hawks hovering in the air are abundant, and once I saw a Vulture also high up in the air. The Hoopoe too is frequent, a beautiful bird which I only knew before in books and pictures. Our noisy friend the Jackdaw is in full force here as elsewhere, and I think he completes the list of the birds I saw in Teneriffe. Palma, the other island we visited, is, though of the same character, smaller, more richly wooded, and the mountain ravines more accessible than in the larger island. A mule ride of an hour from the coast (there is but one carriage-road in the island) takes you up 2000 feet into a glorious forest depth of Canary Laurel and Canary Pine. Here is shade and solitude with open vistas here and there through which you look down over plantations of Bananas, Peach, and Nectarine trees, and gardens full of Roses, with the bluest of seas beyond. There are more wild flowers here than in Teneriffe, most notably the wild Cineraria, with a handsome mauve blossom, the original stock we suppose of our greenhouse varieties. And by its side, with eyes brighter and bluer than ever, grows our dear English Forget-me-not. The Ferns too are various, luxuriant, and attractive; except the Maidenhair, all new to me.

From the thick foliage of the Laurel come the home-like notes of the Robin, and from the rocks above the less musical voice of the Chough, or Red-legged Crow. It is remarkable that this handsome bird, though common in Palma, is unknown in Teneriffe, except in a cage; in which it is in much esteem as a pet by those who do not mind noise! We

were told that the birds of one island never visit the other, and yet they are only sixty miles apart. But the Swallows, we cannot tell what they do, their sweeping wings are to be seen everywhere, though as there are no chimneys, we cannot tell where they make a home !

There is one more beautiful thing of which I should like to speak, and that is the sea. "There are two voices," the poet tells us, "one is of the sea, and one is of the mountains"; here we have both to those who have ears to hear. The coast round the Bay of Oratava is very picturesque, with bold rocky headlands jutting out from the land, and huge boulders piled up on the shore. Even when one is only conscious of a gentle breeze, there is always a grand swell rushing in from the Atlantic, and the waves dash over these rocks with all the fury of a storm. And the contrast between the dazzling white of the tossing spray and the intense blue of the sea is most fascinating to watch as you stand on the little pier, or sit on the beach under the Tamarisks. At low water, the pools left by the tide are crowded with tiny fishes; fishes striped, banded, shaded in all sorts of colours, and, most unusual of all, some of a deep indigo blue; I never saw such "got up" fishes before. At high water there are new interests; not many seaweeds are washed up, but bits of coral and sponge, while the tinted bladders of the Portuguese Man-of-war lie everywhere. The most frequent shells are two which I have always thought special treasures in my cabinet at home, here most abundant,—the Crozier Nautilus and the Violet Snail. How such fragile things can survive the tremendous force of the waves is a mystery; perhaps it shows, as Kingsley says, "that the sea is a gentle creature after all."

These two islands were the only ones we visited, but Gran Canary is also much frequented. The other four islands have not yet much accommodation for travellers, though all we believe are interesting. We can only add testimony that these Fortunate Isles are indeed fortunate and favoured, and for myself I can but feel deeply thankful that I have been permitted these fresh experiences of God's beautiful world,

and can only wish that others may go and get a share of the same.

The paper was illustrated by specimens of several plants from the Canaries referred to.

Mr. C. E. Salmon read a paper entitled 'SHORT BOTANICAL RAMBLES':—

A very enjoyable Whit-Monday ramble was one which we took in the neighbourhood of Elstead. Starting from Shalford early we took the towing-path running by the Wey-side towards Godalming. Here was the tall Meadow Rue (*Thalictrum flavum*) coming up into flower amid dense patches of Comfrey, purple and white.

As we approached Godalming, that typical plant of the neighbourhood, *Geranium lucidum*, appeared in plenty, and accompanied us several miles on the other side as well.

Passing Godalming, we took the road and footpaths as far as Elstead, and soon after struck across the heath which stretches from here to Haslemere and Frensham, a glorious expanse of wild open country.

We carefully dredged some streams on Royal Common, and the drag came up with a shiny mass of *Nitella translucens* in very fine condition, covered with fruit.

Round Elstead *Anthriscus vulgaris* was abundant, and on one hedgebank were the remains of *Claytonia perfoliata*, where we had noticed it the year before.

Carex arenaria, not often seen inland, though growing in the neighbourhood of Frensham, grew on a sandy hedgebank not far from Elstead.

On Hankley Common the little *Scleranthus biennis* was abundant on the bare sand, and the Climbing Corydalis trailed over the stunted bushes. In the marshier parts of the heath, *Carex curta* grew, and *Ranunculus Lenormandi* flowered in the pools. The dry sandy tracks over the common were very favourable to the growth of *Potentilla argentea*, which grew plentifully, and to a large size; also the peculiar *Trifolium subterraneum*.

A long walk over Thursley Common, past Silk Mill, brought us to Witley, where we took the train home.

A rather good find on Thursley Common was a Cotton-grass, *Eriophorum vaginatum*, which was plentiful round the margin of a pond on the heath; this plant, according to Brewer's 'Flora,' has only four other localities in Surrey. This brought to a close a really most enjoyable Bank Holiday ramble.

One of the rarest of British plants, belonging to the great Pea tribe, tempted us one afternoon last July to make a rather unusually long journey of thirty miles. The plant I refer to is *Lathyrus tuberosus*, and its locality is Fyfield, but Ongar is the nearest railway approach.

As far as I know, this locality and two others, one on Canvey Island, the other near Southend, all in the county of Essex, are the only places where this very rare plant grows. According to some it is a doubtful native, but at any rate in the Fyfield locality, where it is spread over a considerable area, if introduced, it has become well naturalized.

Arrived at Ongar then, a three mile walk along the high road brought us to the pretty little village of Fyfield. The first plant worth mentioning that turned up was a variety of the Common Water Plantain, called *lanceolatum*, having lanceolate leaves in place of the ordinary heart-shaped ones. This form grew in ditches by the high road.

As the locality for the *Lathyrus* was described as "corn-fields about Fyfield," of course, as soon as we reached that place, we left the road, and took footpaths that led through several "likely-looking" fields of wheat and oats. Here we came across a very nice plant, in the shape of the Night-flowering Catchfly (*Silene noctiflora*), with its petals, at this time of day, rolled up and scentless. There was plenty of it in several of the fields, so I was enabled to take a few roots, which have lived and flowered in the garden. Even in the vasculum on the way home, the petals expanded from their rolled up condition of daylight, and gave out a very pleasant scent, which, no doubt, attracts great numbers of night-flying insects, moths, &c.

Three or four large fields had been carefully looked over, as far as we could see from the footpaths, and still no *Lathyrus* appeared. The time was approaching when we must necessarily turn back to catch our train, when we were overjoyed at seeing, quite close to the footpath, a beautiful climbing plant of the great prize, the Tuberous Pea. It was just coming into flower, and had carefully wound itself round many of the stems of the wheat, just after the manner of a *Convolvulus*.

A little further on, in another field, it occurred quite plentifully, and close by were several very luxuriant specimens trailing over a low hedge, and making it quite gay with its flowers,—a beautiful pink colour, tinged with crimson. We could now gather as many specimens of it as we desired, and feeling well satisfied with our good fortune we turned back for Ongar.

A rather uncommon Bedstraw, *Galium tricornes*, occurred in the cornfields round Fyfield, its peculiar granular fruit on reflexed stalks distinguishing it from other species.

By the roadside, on our return to the station, a specimen of a very curious plant was gathered. It had the pale blue flowers of a Forget-me-not, but the stem, hard and woody, was that of a *Lithospermum*. This peculiar plant afterwards proved to be a casual *Echinospermum lappula*, but how it got to be growing by the roadside, far from cultivation, was a mystery; for it had all the appearance of an undoubted native.

He showed specimens of most of the plants named in the paper.

EVENING MEETING.—DECEMBER 16TH, 1892.

The following presentations were made:—‘Contributions toward a Flora of Caithness, No. 2,’ by Mr. A. Bennett, a reprint; presented by the Author. ‘Part of a Flora of North Yorkshire’ by J. Gilbert Baker; presented by the Yorkshire Naturalists’ Union. North Staffordshire Naturalists’ Field

Club and Archæological Society, Annual Report and Transactions, 1892; presented by the Club.

A paper by Messrs. E. S. Salmon and A. J. Crosfield was read entitled 'A WEEK IN TEESDALE':—

The writers of this paper described a large number of plants found in Teesdale during a week in June, 1892, many of which belong to the northern Flora, and do not occur further south than the Midland Counties, whilst several of the rarer ones are confined to Teesdale and a few adjacent counties.

At Barnard Castle they gathered *Stellaria nemorum*, *Geranium sylvaticum*, *Myosotis sylvatica*, *Alchemilla vulgaris*, *Geum rivale*, and *G. intermedium*, *Myrrhis odorata*, *Trollius europæus*, and *Prunus Padus*.

In the region lying around the High Force the plants met with included *Primula farinosa*, *Viola lutea*, *Trollius europæus*, *Geranium sylvaticum*, *Alchemilla vulgaris*, *Myosotis sylvatica*, *Polygonum viviparum*, *Potentilla fruticosa*, *Equisetum sylvaticum*, *Melica nutans*, *Sesleria cærulea*, *Polypodium Dryopteris*, *P. Pheopteris*, *Lastrea Filix-mas*, var. *Borreri*, *Carex capillaris*, *Bartsia alpina*, *Tofieldia palustris*, and *Carex dioica*.

On Cronkley Fell, on the Yorkshire side of the Tees, were found *Potentilla maculata*, *Vaccinium Vitis-idea*, *Cryptogramme crispa*, *Asplenium viride*, *A. trichomanes*, *Cystopteris fragilis*, *Empetrum nigrum*, *Lycopodium Selago*, *Polygala uliginosa*, *Draba incana*, *Helianthemum marifolium*, var. *vineale*, a stalkless variety of *Primula farinosa*, *Dryas octopetala*, and *Juncus triglumis*.

On the Durham side of the Tees, in the village of Langdon, *Pastinaca Ostruthium* occurred by the roadside. Between Langdon and Widdy Bank *Sedum villosum*, *Scirpus Caricis*, *Gentiana verna*, and *Bartsia alpina* were gathered.

The most interesting plants on Widdy Bank Fell include *Rubus Chamæmorus*, *Alsine verna*, *A. uliginosa*, *Viola arenaria*, and *Juncus triglumis*. On the cliffs forming its southern face *Hieracium bifidum* was obtained.

Higher up the valley, not far from the source of the Tees,

Thlaspi alpestre var. *occitanum* (identified by Mr. Arthur Bennett, F.L.S.) grew abundantly amongst limestone rocks.

Amongst the other rareties of the district, one of the most charming is the Alpine Forget-me-not, *Myosotis alpestris*, which has long been known on Mickelfell at an elevation of nearly 2500 feet.

A lively description was given by the writers of this paper of the two grand falls of the Tees—the High Force, where the river falls over a precipice of basaltic rock 69 feet in height into a seething pool beneath ; and Cauldron Snout, which is more of a rapid, broken by huge boulders of rock that block up the gorge until the whole torrent rushing down the steep descent of 200 feet is one white, foaming mass.

Less known amongst the natural features of the district is the wild, cliff-bound valley called High Cup Nick, in Westmoreland. The following is the description given of it:—
“ Rather wearisome had the walk become over this wild stretch of moorland when we reached a point from which a new and wondrous panorama opened before us. We had come to the edge of a wild valley of most striking aspect. Far, far below us ran a trickling stream flowing south-westward to join the Eden, and flow into the Solway Frith. Between us and the stream was a steep hillside hundreds of feet in height. About half-way down the hillside an escarpment of almost precipitous cliffs formed a barrier to our descent. Following with the eye the line of these cliffs we could see that they hemmed in the sides and head of the valley as with a battlement. On the opposite side the hills rose again yet higher than the moorland on which we stood. One questions if there is a more impressive piece of mountain scenery in England than this view of High Cup Nick.”

‘ A REPORT OF EXCURSIONS FOR 1892,’ was read by Mr. Charles E. Salmon.

A large number of specimens of plants from Teesdale were exhibited by Messrs. Salmon and Crosfield.

RULES.

NAME.

I.—The Association shall be styled "THE HOLMESDALE NATURAL HISTORY CLUB."

OBJECTS.

II.—The investigation of the Natural History of Reigate and its vicinity, and the mutual improvement of the members in the study of Nature.

CONSTITUTION.

III.—The Club shall consist of Members, Subscribers, Corresponding Members, and Honorary Members.

MEMBERS.

IV.—Members shall be elected by ballot or show of hands at any Ordinary Meeting. The candidate to be recommended by one or more Members at any Ordinary Meeting, and the election to take place at the Meeting next ensuing.

SUBSCRIBERS.

V.—Subscribers shall be elected in the same manner as Members, and shall have all the privileges of Members, except of holding any office in the Club, or of voting upon any matter connected therewith, or of having any right or ownership in the property of the Club.

CORRESPONDING MEMBERS.

VI.—It shall be competent for the Club to elect as Corresponding Members any gentlemen distinguished for their attainments in Natural History, either as collectors or authors, or to whom the Club may be indebted for contributions of papers or specimens; such Corresponding Members to have similar privileges to Subscribers without payment, and to be elected by the Club upon the nomination of the Committee.

HONORARY MEMBERS.

VII.—Honorary Members shall be elected by the Club upon the nomination of the Committee; and shall be exempted from the payment of subscriptions, and shall have the privileges of Subscribers.

OFFICERS.

VIII.—The Club shall, at the Annual General Meeting, elect from among themselves a President, Treasurer, Secretary, Curator, and nine Members to form a Committee of Management, three of whom to form a quorum.

VICE-PRESIDENTS.

IX.—The President shall nominate annually two Vice-Presidents from the members of the Committee.

ANNUAL GENERAL MEETING.

X.—This shall be held previous to the Evening Meeting on the third Friday in October, when the Committee shall present a Report detailing the general state, proceedings, and pecuniary condition of the Club, and proceed to the election of Officers.

SPECIAL MEETINGS.

XI.—The Committee shall have the power to call a Special General Meeting at any time; and they shall do so within four weeks after receiving requisition to that effect, signed by at least five Members. The notice calling the Meeting shall state the objects for which the Meeting is called, and no other business shall be transacted.

ORDINARY MEETINGS.

XII.—These shall be held on the third Friday in every month, from October to April, inclusive, or more frequently at the option of the Committee.

SUBSCRIPTIONS.

XIII.—Each Member shall pay to the Treasurer Ten Shillings on his election, and the same sum at the Annual General Meeting each year; but may compound for such Annual Subscription by payment of Five Pounds. Each Subscriber shall pay to the Treasurer Five Shillings on his election, and the same sum at the Annual General Meeting each year. That it shall be optional with the Committee to strike out the name of any Member or Subscriber who shall be in arrear with his Subscription for twelve months or more.

NEW RULES.

XIV.—Any five members, wishing to propose a New Rule, or the omission or alteration of any existing Rule, must send notice to the Secretary, who shall within a month call a Special General Meeting to consider the change proposed.

LIBRARY AND COLLECTIONS.

XV.—The Club shall form, as opportunity may offer, a Library of Reference, consisting of works bearing on the subject of Natural History; and obtain collections of the natural objects of the neighbourhood. The Library, Collections, and Funds to be the property of the Members for the time being, and shall be vested in Trustees for the use of the Members. Contributions of Life Members shall also be invested in the names of such Trustees in such manner as the Committee may direct, the interest arising therefrom to be handed to the Treasurer for the general purposes of the Club.

ELECTION OF TRUSTEES.

XVI.—The Trustees shall consist of the President for the time being, and three other Members to be elected by the Club.

LIST OF MEMBERS AND SUBSCRIBERS.

*Names marked * are Honorary Members.*

- ADENEY, Miss; Bushey, Reigate.
BARFORD, T. J., B.Sc.; Grammar School, Reigate.
BAXTER, ROBERT C.; Hethersett, Reigate.
BEEBY, W. H.; Vaila, Burwood Park Road, Walton-on-Thames.
*BENNETT, ARTHUR, F.L.S.; High Street, Croydon.
BLAKE, ARTHUR; Dean House, Redhill.
BONNOR, JAMES; Linkfield Lane, Redhill.
BOSSEY, FRANCIS, M.D.; Mayfield, Redhill.
BRASS, Rev. HENRY, M.A.; Redhill.
*BROWN, N. E.; Herbarium, Kew.
COCHRANE, W., B.A.; Upland Villa, Redhill.
CONOLLY, W.; Buckhurst, Redhill.
COOPER, THOMAS; Brighton Road, Redhill.
CROSFIELD, JAMES B.; Undercroft, Reigate.
CROSFIELD, HERBERT; do.
CROSFIELD, Miss; do.
CROSFIELD, ALBERT J.; Carr End, Reigate.
CROSFIELD, Mrs. A. J.; do.
CUDWORTH, JAMES I.; Woodcote, Reigate.
CUDWORTH, Mrs. J. I.; do.
ELLWOOD, F. H.; Station Road, Redhill.
*EVELYN, W. J.; Wotton House, Dorking.
EWEN, H. W., M.R.C.S.; Station Road, Redhill.
FARDON, Miss; Taisboro, Reigate.
FARDON, ALBERT H.; do.
FERNELEY, CHARLES A.; High Street, Reigate.
GARDNER, Rev. J.; Redhill.
GIBBS, GEORGE F.; Reigate.
GILFORD, WILLIAM; Beech Grove, Redhill.
GOUGH, ALFRED B.; Sandcroft, Redhill.
GOUGH, BERNARD B.; do.
GRANT, SPENCER W.; Linkfield, Redhill.
GRANT, Mrs.; do.
GURNEY, HENRY; Nutwood, Reigate.
HARDING, Miss LILY; Mount Sandford, Reigate.
HARRIS, W. O.; The Hatch, Redhill.
HEATON, WILLIAM H.; Englewood, Reigate.
HESKETH, R. L.; Ringley Mead, Reigate.
HOBDAY, FREDERICK T. G., M.R.C.V.S.; Dean House, Redhill.
HOLMAN, CONSTANTINE, M.D., J.P.; London.

- HOLMAN, Mrs. C.; do.
 HOOPER, T. R.; Redhill.
 HORNE, EDWARD, J.P.; Park House, Reigate.
 HORNE, Miss; Warwick Road, Redhill.
 INGRAM, ALBERT W.; Amberley, Reigate.
 KNIGHT, J.; Meadvale, Redhill.
 LEES, JOHN; Reigate.
 LEMON, F. E.; Redhill.
 LINNELL, JOHN; Redstone Wood, Redhill.
 LUBBOCK, Sir JOHN, Bt., M.P.; 15, Lombard Street, London, E.C.
 LURY, SAMUEL H.; North View, Redhill.
 MARTIN, Miss; Oxford Road, Redhill.
 NEWMAN, THOMAS P.; Hazelhurst, Haslemere.
 NICHOLSON, JAMES; Salmon's Cross, Reigate.
 PADWICK, THOMAS; Station Road, Redhill.
 PAICE, P. C.; Gatton Point, Redhill.
 PAULL, Rev. W. MAJOR; Park Road, Redhill.
 PAWLE, FREDERICK C.; Northcote, Reigate.
 PAXON, G. W.; Cotmandene, Dorking.
 POULTER, DANIEL P.; Gloucester Road, Redhill.
 POWELL, Mrs.; Ivanhoe, Reigate.
 READER, PERCY; High Street, Reigate.
 SALMON, SAMUEL; Clevelands, Reigate.
 SALMON, Mrs.; do.
 SALMON, Miss I. E.; do.
 SALMON, ERNEST S.; do.
 SALMON, CHARLES E.; do.
 SARGANT, Miss; Quarry Hill, Reigate.
 SHARP, J. B.; Northbrook, Reigate.
 SILLITOE, F. S., JR.; Station Road, Redhill.
 SMITH, F., JR.; c/o Mr. Brine, Edenbridge.
 SPRULES, G. H.; Mansfield, Reigate.
 SPRULES, Miss; do.
 TYNDALL, WILLIAM H.; Morlands, Redhill.
 WALTERS, JOHN, M.B., J.P.; Church Street, Reigate.
 WEBB, HENRY; Redstone Manor, Redhill.
 WEBB, SYDNEY; Maidstone House, Dover.
 WESTLAKE, ERNEST; Ridgeway Road, Redhill.

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